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Attitudes of Women at the University of Michigan Toward Physical Education

MARGARET BELL, C. ETTA WALTERS, AND STAFF
University of Michigan
Ann Arbor, Michigan

STUDIES IN ATTITUDES have ranged from the questionnaire type, in which subjects check likes and dislikes of certain features and activities in a program, to prepared attitude scales, in which qualitative responses are checked in answer to statements indicating an attitude toward a part of a program.

Carr (2), using an attitude scale based on the Thurstone method, concluded from her study that the attitudes of entering high-school Freshmen girls influenced their success in physical education and suggested that "if undesirable attitudes are obstacles to learning they should be removed."

Baker (1), in a questionnaire survey study of 1,150 girls and women between the ages 15-25, concluded that attitudes concerning participation in physical education do not regulate participation so much as they reflect the influence of other causes which do.

Moore (3) in her study found college women to have a highly favorable attitude toward physical activity as a means of recreation. However, the average amount of time spent in physical activity was low, with approximately 50 per cent of the girls spending less than four hours per week. The main reasons for not spending more time on physical activity were lack of time owing to study, lack of companions, and outside work.

Nelson (4) found differences in attitudes between high-school boys taking ROTC and those taking physical education. Those who took physical education had a more favorable attitude toward competition, games, and athletics.

Nemsen (5) studied the annoyances of high school boys toward physical education. He found that many of the annoyances could be removed but that most of them involved the personality or behavior of other students or the instructor.

A periodic analysis of students' attitudes and reactions toward various phases of a program offers a valuable aid in evaluation.

Purpose

It was therefore the purpose of this project to study the attitudes of college women at the University of Michigan in an attempt to help evaluate the physical education program. All Freshmen who were taking physical education, and Seniors who had taken required physical education at the University of Michigan were studied.

Procedure

A questionnaire (see Appendix I, page 385) consisting of three parts was devised to study attitudes. Part I was a checklist response to informational questions pertinent to the background of the subjects. Part II consisted of questions based on the objectives of physical education, and Part III was the Wear (4) Attitude Scale, which is a prepared attitude scale toward physical education as an activity course and is totaled as an attitude score. Attitude, in this paper, will refer to the attitude score on the Wear Scale. A high score on the scale indicates a favorable attitude.

The questionnaire was given during the last part of the fourth quarter in a two-semester physical education required program. To check reliability, the questionnaire was given twice to 150 Freshmen. A total of 173 Seniors and 684 Freshmen answered the questionnaire.

Results and Their Interpretation

An analysis of Table 1 shows that 288 out of 665 Freshmen (42%) spend from three to five hours per week, outside of physical education class, on physical activity, while only 47 out of 151 (18%) of the Seniors spend that much time.

The reasons why students did not spend more time than this on physical activity is shown in Table 2. The main reasons given for both Freshmen and Seniors are study, extra-curricular activities, and work. However when we compare the reasons given by Freshmen with those of Seniors we find differences in the area of study (80% of the Freshmen listed it as compared to 59% of the Seniors), in extra-curricular activities (29% of the Freshmen and 41% of the Seniors), and in lack of initiative (7% of the Freshmen listed it as compared to 19% of the Seniors). The figures obtained substantiate what one might expect to find.

TABLE 1

Average Amount of Time Spent per Week in Physical Activity

Hours[1]	Freshmen N	%	Seniors N	%
5	62	9	10	1
4	84	12	10	1
3	142	22	27	16
2	183	28	31	31
1	139	21	53	32
0	55	8	30	19
Total	665	100	151	100

[1]Hours do not include those spent in physical education classes.

For an analysis of Parts II (objectives) and III (attitude) of the questionnaire, the Freshmen and Seniors were divided into those who had and those who had not had physical education in high school.

TABLE 2

An Analysis of the Reasons Why Students Do Not Spend More Time on Physical Activity

Reasons	*Freshmen* Times checked	% of Total N (684)	*Seniors* Times checked	% of Total N (173)
Study	545	80	102	59
Extra-curricular	201	29	72	41
Work	101	15	40	23
Lack of skill	91	13	24	14
Lack of initiative	50	7	34	19
No opponent	59	9	18	11
Facilities not available	80	11	28	16
Other reasons	48	7	19	11

Table 8 (see Appendix III, page 390) shows the response of the students to the questions in Part II (objectives of physical education). The results shown in this table might cause us to ask ourselves the questions, "Are we claiming too much for our objectives of physical education at the college level?" "In our classes do we teach health principles, develop leadership, self-confidence, and all the things we believe should be developed?"

According to what the Freshmen think, we do a fairly good job in:

1. Providing opportunity for the development of specific skills which could be adapted for their own pleasure.
2. Developing friendships with other girls in the class.
3. Providing activities for them to learn that will be social assets to them.
4. Giving them a feeling of well-being through activity.

Those that the Freshmen rated low were as follows:

1. Giving them a knowledge of health principles useful for daily living.
2. Developing in them a feeling of responsibility for others.
3. Giving them an opportunity to develop leadership.

The Seniors rated on the high end of the scale the same objectives listed above as the Freshmen, except the one developing friendships with other girls in the class. They rated low the same questions that the Freshmen rated low with the addition of the following statements:

1. Developing self-confidence through the course.
2. Feeling that the activity gave them an opportunity for self-expression.
3. Feeling that the course gave them an understanding of the beauty of movement and an appreciation of it in others.

An analysis of Table 3 shows that the Freshmen who have had physical education in high school have a higher, and thus a more favorable, attitude toward physical education than any other group studied. When compared statistically (Table 4), we find this difference to be a true one.

Table 5 presents some relationships which help to give us a better insight into factors influencing program and teaching. When their attitude was cor-

TABLE 3

Mean Scores Obtained by Students on Attitude Test (Part III) (A High Number Indicates a Good Attitude)

	N	Mean Attitude	S.D.	S.E. of Mean
Freshmen P.E. in H.S.[1]	568	158	19.15	.81
Freshmen No P.E. in H.S.	72	153	19.67	2.23
Seniors P.E. in H.S.	141	150	21.86	1.84

[1]P.E. in H.S. refers to physical education in high school.

TABLE 4

Intergroup Comparison of Mean Attitude Scores

Groups	Significance Ratio	Level of Confidence (%)
Freshmen (P.E. in H.S.) with Freshmen (No P.E. in H.S.)	2.15	5.0
Freshmen (No P.E. in H.S.) with Seniors (P.E. in H.S.)	1.10	30.0
Freshmen (P.E. in H.S.) with Seniors (P.E. in H.S.)	5.10	0.1

TABLE 5

Intercorrelations of Selected Statements (Objectives—Part II) and Attitude (Part III)

Correlation	Freshmen				Seniors	
	P.E. in H.S. N	P.E. in H.S. r	No P.E. in H.S. N	No P.E. in H.S. r	P.E. in H.S. N	P.E. in H.S. r
7 with Attitude	568	.57	72	.14*	141	.45
13 with Attitude	554	.59	72	.39	141	.45
8 with 13	554	.41	82	.32	141	.49
8 with 14	563	.19	73	.18*	141	.39

Note: All correlations with the exception of those marked with an asterisk (*) are significant at the 1 per-cent level of confidence.

7—Importance of sports and dance in their present recreational program.
8—Extent to which the instructors are interested in them as individuals.
13—Extent to which they enjoy their physical education class.
14—Extent to which they are motivated to continue in physical activities outside of class.

related[1] with the importance they attached to sports and dance in their present recreational program and with the extent to which they enjoyed their physical education class, the correlation was shown to be a positive one. This relationship was higher for the Freshmen who had had physical education in high school than for those who had not had it.

The correlation[1] of question 8 (the extent to which instructors are interested in them as individuals) with 13 (the extent to which they enjoyed their physical education class), and the correlation[1] of question 8 with question 14 (the extent to which they are motivated to continue in physical activities outside of class) should encourage us to re-evaluate our teaching in terms of the individual. Because enjoyment is so fundamental to continuing in an activity after it is learned, and because it is a strong motivating force in the learning process, it might be wise periodically to ask ourselves the question, "Am I teaching people or am I teaching just an activity?"

For a further analysis of the students' attitude toward required physical education, the 40 statements in the Attitude Scale (Part III) were classified into three areas of contribution—social, physical and mental health (see Appendix IV, page 391. Ten statements were in the social category, eight in physical health, and nine in mental health. Thirteen statements in the Scale did not fall into any of these classifications. Table 6 gives the percentage of students checking in each level on the Scale of the three categories. It is apparent from it that the reaction of the students to the statements in each area was one of a very favorable response. Sixty-nine to 84% of the Seniors and Freshmen rating all the statements in the 4 and 5 level of the Scale, indicating they "agreed" and "strongly agreed" with the statements. The response to the statements in the area of mental health indicated that both the Freshmen (84%) and Seniors (80%) had a more favorable response to the contribution of physical education in this area than in any other.

Conclusions

The results, based upon this study, appear to justify the following conclusions.

1. Individual sports are the physical activities, outside of physical education class, most frequently engaged in by Freshmen and Seniors, with group activities running second from 22 to 27 per cent for Freshmen and Seniors, respectively.
2. Outside of physical education classes, Freshmen spend a greater percentage of their time on physical activities than do Seniors.
3. A greater percentage of the Freshmen than the Seniors thought we were accomplishing our objectives.
4. Freshmen who have had physical education in high school have a higher mean attitude toward physical education as an activity course than Fresh-

---

[1] $$r = \frac{N\Sigma XY - \Sigma X \Sigma Y}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2]\,[N\Sigma Y^2 - (\Sigma Y)^2]}}$$

TABLE 6

Response of 684 Freshmen and 173 Seniors to Total Number of Statements in Part III (Attitude Category)

Categories Scale[1]	Freshmen														Seniors							
	P.E. in H.S.								No P.E. in H.S.						P.E. and No P.E. in H.S.							
	5 & 4		3		2 & 1		Total		5 & 4		3		2 & 1		Total		5 & 4		3		2 & 1		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Social	4190	73	811	14	680	12	5681	99	561	76	102	14	75	10	738	100	1132	69	241	15	262	16	1635	100
Physical Health	3560	77	653	14	394	9	4607	100	439	74	98	17	53	9	590	100	977	73	201	15	167	12	1345	100
Mental Health	4201	81	631	13	324	6	5056	100	553	84	62	9	42	6	657	99	1185	80	183	12	121	8	1489	100

[1] 5 & 4—Upper level of scale indicating "strongly agree" and "agree" which indicated a favorable attitude.
3—"Undecided."
2 & 1—Lower level of scale indicating "disagree" and "strongly disagree" which indicates an unfavorable attitude.

men who have had no physical education in high school, and higher than Seniors who have had physical education in high school.

5. There is no true difference in the mean attitude of Freshmen who have had no physical education in high school and Seniors who have had physical education in high school.
6. There seems to be a positive and significant relationship between the following:
   a. Attitude and the importance of sports and dance as part of their recreational program. This is true for all groups except the Freshmen who have had no physical education in high school.
   b. Attitude and the extent to which they enjoy physical education classes.
   c. The extent to which the instructors are interested in them as individuals and the extent to which they enjoyed their physical education classes.
   d. The extent to which the instructors are interested in them as individuals and the extent to which they were motivated to continue in physical activities on their own outside of class. This is true for all groups except Freshmen who had had no physical education in high school. A small relationship exists in the other groups.
7. On the attitude scale of Part III, all students rated on the high end of the scale the social, physical, and mental health attributes of physical education as an activity course, with the area of mental health being rated the highest by all three groups.

REFERENCES

1. Baker, Mary C. Factors Which May Influence the Participation in Physical Education of Girls and Women 15-25 Years of Age. *Research Quarterly*, **11**: 126-131, 1940.
2. Carr, Martha G. The Relationship Between Success in Physical Education and Selected Attitudes Expressed by High School Freshmen Girls. *Research Quarterly*, **16**: 176-91, 1945.
3. Moore, Beverly Y. The Attitude of College Women Toward Physical Activity as a Means of Recreation. *Research Quarterly* **12**: 720-25, 1941.
4. Nelson, G. A. Personality and Attitude Differences Associated with the Elective Substitution of ROTC for the Physical Education Requirement in High School. *Research Quarterly* **19**: 2-17, 1948.
5. Nemson, Edward. Specific Annoyances in Relation to Student Attitude in Physical Education Classes. *Research Quarterly* **20**: 336-347, 1949.
6. Wear, Carlos L. The Evaluation of Attitude Toward Physical Education as an Activity Course. *Research Quarterly* **22**: 114-126, 1951.

APPENDIX I

Questionnaire Given to Freshmen

We are asking your co-operation in filling out the following information to the best of your knowledge. We do not want your name on it. It is not to be used for grading purposes, but as an aid in helping us to evaluate our program and to improve it.

CLASSIFICATION: (Freshman, Senior) Please underline.

Age to Nearest Birthday:

Part I—Background Data

Please put an V in front of the correct response.

1. Did you have an instructional class in physical education in high school?
   A. Yes
   B. No
2. If the answer to Question 1 is yes, how large, on an average, were the classes?
   A. Large (45 or over)
   B. Medium (25 to 45)
   C. Small (25 or under)
3. Was there an opportunity in high school to take
   A. Just team sports (basketball, volleyball, baseball, etc.)?
   B. Just individual sports (tennis, golf, bowling, swimming, etc.)?
   C. Both team and individual sports?
   D. Dance?
4. Did you have physical education classes in the elementary school?
   A. Yes
   B. No
5. Outside of physical education classes, what type of physical activity do you engage in most frequently at the present time?
   A. Social activity (folk and square dancing, recreational games).
   B. Individual sports (tennis, golf, bowling, swimming, hiking, skating).
   C. Organized team sports (basketball, volleyball, baseball, hockey).
   D. Any other.
6. Outside of physical education classes, how much time a week during the school year, on an average, do you spend in physical activity as listed in the above question?
   A. Five hours or more.
   B. Four hours.
   C. Three hours.
   D. Two hours.
   E. One hour.
   F. None.
7. Is this as much time as you would like to spend on physical activity of this kind?
   A. Yes
   B. No

   If No, what are your main reasons for not spending more? Please check.
   a) Lack of time due to:
      (1) Study
      (2) Work
      (3) Extra-curricular activities
      (4) Others
   b) Lack of skill
   c) Lack of initiative
   d) No opponent or companion
   e) Lack of finances
   f) Facilities not readily available.
8. What courses have you taken in physical education at the University of Michigan?
9. What courses would you have liked to have taken but couldn't for various reasons?
10. As to your health rating, were you able to take any physical activity?
    A. Yes
    B. No

    If no, what was your restriction as to sport activities?

Part II

There is no correct or incorrect answer to the following questions. It is simply a matter of your personal opinion. Read the question carefully and then circle the number which

refers to your response. For example, if you enjoyed something or participated in it to a great extent, mark it as follows: 5 is the highest rating and the numbers refer to the following code.

A GREAT DEAL	*QUITE A BIT*	*SOME*	*A LITTLE*	*NOT AT ALL*
5	4	3	2	1

1. To what extent did you enjoy physical education classes in high school?
2. Outside of phsyical education classes, to what extent (at present time) do you like to participate in team sports?
3. Outside of physical education classes, to what extent (at the present time) do you like to participate in individual sports (tennis, golf, bowling, swimming, etc.)?
4. Outside of physical education to what extent (at present time) do you like to participate in folk or square dancing?
5. To what extent does lack of skill keep you from actual participation in sport activities?
6. Outside of physical education classes, to what extent are you kept from actual participation by the inconvenience of changing your dress, showering, etc.?
7. How important do you consider sports and dance at the present time as part of your recreational program?

Answer the Following Questions in Regard Specifically to Your Courses in Physical Education at the University of Michigan.

8. To what extent do you feel that your instructors are interested in you as an individual?
9. To what extent are you made aware of the importance of safety factors in avoiding accidents?
10. To what extent do you have an opportunity for the development of specific skills which increase your feelings of achievement?
11. To what extent are you given an opportunity for the development of specific skills which could be adapted for your own pleasure?
12. To what extent do your physical education classes give you a knowledge of health principles useful for daily living?
13. To what extent do you enjoy your physical education classes?
14. To what extent are you motivated to continue in physical activities on your own outside of class?
15. To what extent does the class help you in developing a feeling of responsibility for others, e.g. including the less skilled player in your group, sharing equipment, etc.?
16. To what extent are you given an opportunity to develop leadership?
17. To what extent do you develop friendships with other girls in the class?
18. To what extent do you feel that the activities you are learning are or will be social assets to you?
19. To what extent does the course help you to develop self-confidence?
20. To what extent do you think the time spent in physical education classes is of value to you?
21. To what extent do you experience a feeling of well-being due to activity?
22. To what extent do you feel the activity gives you an opportunity for self-expression?
23. To what extent does the course give you an understanding of the beauty of movement and an appreciation of it in others?
24. Your comments on anything not covered in the questionnaire will be welcomed. Please feel free to list them here.

Part III

Please Read Carefully

"Below you will find some statements about physical education. We would like to know how you feel about each statement. You are asked to consider physical education only from the standpoint of its place as an activity course taught during a regular college

class period. No reference is intended in any statement to interscholastic or intramural athletics. People differ widely in the way they feel about each statement. There are no right or wrong answers." (5) Indicate your own opinion of the statement by circling the X under the word or words that best expresses your feeling about the statement.

STRONGLY AGREE AGREE UNDECIDED DISAGREE STRONGLY DISAGREE

Statements:

1. If for any reason a few subjects have to be dropped from the school program, physical education should be one of the subjects dropped.
2. Associations in physical education activities give people a better understanding of each other.
3. Engaging in vigorous physical activity gets one interested in practicing good health habits.
4. Physical education activities provide no opportunities for learning to control the emotions.
5. Physical education is one of the more important subjects in helping to establish and maintain desirable social standards.
6. The time spent in getting ready for and engaging in a physical education class could be more profitably spent in other ways.
7. Vigorous physical activity works off harmful emotional tensions.
8. A person's body usually has all the strength it needs without participation in physical education activities.
9. I would take physical education only if it were required.
10. Participation in physical education activities tends to make one a more socially desirable person.
11. Participation in physical education makes no contribution to the development of poise.
12. Physical education in schools does not receive the emphasis that it should.
13. Because phsyical skills loom large in importance in youth it is essential that a person be helped to acquire and improve such skills.
14. Physical education classes are poor in opportunities for worthwhile social experiences.
15. Exercises taken regularly are good for one's general health.
16. A person would be better off emotionally if he did not participate in physical education.
17. Skill in active games or sports is not necessary for leading the fullest kind of a life.
18. It is possible to make physical education a valuable subject by proper selection of activities.
19. Physical education does more harm physically than it does good.
20. Developing a physical skill brings mental relaxation and relief.
21. Associating with others in some physical education activity is fun.
22. Physical education classes provide nothing which will be of value outside of the class.
23. Physical education classes provide situations for the formation of attitudes which will make one a better citizen.
24. There should not be over two one-hour periods per week devoted to physical education in schools.
25. Physical education situations are among the poorest for making friends.
26. Belonging to a group, for which opportunity is provided in team activities, is desirable experience for a person.
27. There is not enough value coming from physical education to justify the time consumed.
28. Physical education is an important subject in helping a person gain and maintain all-round good health.
29. Physical education skills make worthwhile contributions to the enrichment of living.
30. No definite beneficial results come from participation in physical education activities.

31. People get all the physical exercise they need in just taking care of their daily work.
32. Engaging in group physical education activities is desirable for proper personality development.
33. All who are physically able will profit from an hour of physical education each day.
34. Physical education activities tend to upset a person emotionally.
35. Physical education makes a valuable contribution toward building up an adequate reserve of strength and endurance for everyday living.
36. For its contributions to mental and emotional well-being physical education should be included in the program of every school.
37. Physical education tears down sociability by encouraging people to surpass each other in many of the activities.
38. I would advise anyone who is physically able to take physical education.
39. Participation in physical education activities makes for a more wholesome outlook on life.
40. As far as improving physical health is concerned a physical education class is a waste of time.

APPENDIX II

TABLE 7

Reliability of Attitude Scale and of Statements in Part II (Objectives)

Statements	R	N
6[1]	.86	142
1	.76	134
2	.75	140
3	.70	142
4	.90	142
5	.74	141
6	.36	142
7	.51	138
8	.79	138
9	.52	143
10	.50	137
11	.57	141
12	.66	144
13	.71	140
14	.72	144
15	.59	140
16	.59	139
17	.68	137
18	.62	144
19	.70	138
20	.69	143
21	.67	139
22	.81	143
23	.76	144
Attitude	.9976	136

[1]Question 6 in Part I.

APPENDIX III

TABLE 8

Table Showing the Number of Students Answering Each Question in Part II (Objectives). The Percentage Given Is Based on the Number Answering in the High and Low Parts of the Scale. A High Percentage in the High Level Indicates a Favorable Response.

Question Number	Freshmen P.E. in H.S.			Freshmen No P.E. in H.S.			Seniors P.E. in H.S.		
	N	5 & 4	2 & 1	N	5 & 4	2 & 1	N	5 & 4	2 & 1
		(Percentages)			(Percentages)			(Percentages)	
1	577	57.5	17.68				139	53.96	23.02
2	582	42.96	28.5	74	31.1	43.2	141	47.50	30.49
3	609	77.50	5.60	75	81.33	8.0	142	78.87	5.60
4	577	41.76	35.18	75	44.00	28.0	141	33.33	41.84
5	593	16.86	57.50	76	23.68	46.05	138	16.66	60.14
6	559	5.01	86.04	75	1.33	84.00	141	10.64	73.04
7	584	68.32	12.16	75	69.33	8.00	142	49.29	20.42
8	448	53.34	16.52	76	71.05	9.21	140	35.71	34.28
9	565	53.45	22.30	75	61.33	18.66	142	34.51	36.61
10	576	51.38	15.61	76	48.68	27.63	141	38.30	31.91
11	572	65.38	12.06	65	73.84	9.23	139	43.88	22.30
12	573	24.25	46.59	75	25.33	46.66	138	5.80	72.46
13	568	76.76	7.75	75	76.00	8.00	140	52.14	19.29
14	576	57.98	15.45	76	57.89	18.42	138	36.23	47.10
15	578	35.81	32.69	75	40.00	26.66	142	15.49	54.23
16	577	17.67	57.19	73	17.80	60.27	140	9.29	67.86
17	565	58.40	12.74	71	59.15	15.49	139	38.13	30.94
18	585	76.36	7.7	75	81.33	6.67	144	44.44	20.83
19	566	44.87	24.02	74	48.64	16.21	136	18.38	52.21
20	478	58.99	14.23	75	70.66	12.16	138	40.58	28.99
21	571	53.94	17.86	74	58.10	18.91	135	45.19	25.93
22	516	38.37	31.00	75	37.33	29.33	139	26.62	51.80
23	580	44.65	30.86	76	48.68	26.31	140	29.29	52.86

5 & 4—upper level, indicating "a great deal" and "quite a bit."
2 & 1—lower level, indicating "a little" and "not at all."

APPENDIX IV

Classification of Statements in the Attitude Scale (Part III)

Social

2. Associations in physical education activities give people a better understanding of each other.
5. Physical education is one of the more important subjects in helping to establish and maintain desirable social standards.
10. Participation in physical education activities tends to make one a more socially desirable person.
14. Physical education classes are poor in opportunities for worthwhile social experiences.
17. Skill in active games or sports is not necessary for leading the fullest kind of a life.
21. Associating with others in some physical education activity is fun.
23. Physical education classes provide situations for the formation of attitudes which will make one a better citizen.
25. Physical education situations are among the poorest for making friends.
26. Belonging to a group, for which opportunity is provided in team activities, is desirable for a person.
37. Physical education tears down sociability by encouraging people to surpass each other in many of the activities.

Physical Health

3. Engaging in vigorous physical activity gets one interested in practicing good health habits.
8. A person's body usually has all the strength it needs without participation in physical education activities.
15. Exercises taken regularly are good for one's general health.
19. Physical education does more harm physically than it does good.
28. Physical education is an important subject in helping a person gain and maintain all-round good health.
31. People get all the physical exercise they need in just taking care of their daily work.
35. Physical education makes a valuable contribution toward building up an adequate reserve of strength and endurance for everyday living.
40. As far as improving physical health is concerned a physical education class is a waste of time.

Mental Health

4. Physical education activities provide no opportunities for learning to control the emotions.
7. Vigorous physical activity works off harmful emotional tensions.
11. Participation in physical education makes no contribution to the development of poise.
16. A person would be better off emotionally if he did not participate in physical education.
20. Developing a physical skill brings mental relaxation and relief.
32. Engaging in group physical education activities is desirable for proper personality development.
34. Physical education activities tend to upset a person emotionally.
36. For its contributions to mental and emotional well-being physical education should be included in the program of every school.
39. Participation in physical education activities makes for a more wholesome outlook on life.

(Submitted 2-20-53)

Present Practices in Health Instruction in California Secondary Schools

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THE PURPOSE OF this study[1] was to give desired data regarding health instruction in the secondary schools of California. It was an attempt to find out how much health education is being taught, how it is being taught, and by whom it is being taught. For some time the Bureau of Health Education, Physical Education, and Recreation of the State Department has been desirous of obtaining such information. This study, therefore, has been planned to afford the needed information not only for the State Department, but for institutions of higher learning which prepare teachers of health education.

Procedure

This study was conceived in April 1950, following an interview with Mrs. Cecyl Havelin, consultant in health for the California State Department of Education's Bureau of Health Education, Physical Education, and Recreation (retired). In the fall of 1950, letters were sent to each of the Education Departments of the other 48 states asking for information and samples of similar state-wide surveys. A questionnaire was then prepared which would attempt to give objective data on all aspects of health instruction. On March 3, 1951, a letter co-signed by Verne L. Landreth, chief of the Bureau, and Mrs. Alice L. Spillane, consultant in health, was printed.

This letter and the questionnaire form were sent to all junior- and senior-high-school principals as listed in the California School Directory for the year 1950-51. These were mailed on March 10, 1951. Replies were received through June 15, 1951.

The last few weeks of May and the first two of June 1951, representatives of three junior high schools and 18 senior high schools were interviewed, as well as representatives of two city systems (Los Angeles and San Francisco). These were done as spot checks to test the validity of the questionnaire and to amplify the information to determine the shortcomings of the questionnaire form.

Results

The replies from the questionnaire are shown in Table 1. The junior high school returns were tabulated separately, as were the results of the senior high schools. However, in order to give a total picture of health instruction at the secondary level, the replies were also combined and are reported as follows, together with interpretations and implications.

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[1]This study was done in partial fulfillment of the requirements for the degree of Doctor of Education in the School of Education, Stanford University, 1952, under the direction of Dr. Oliver Byrd.

The questionnaire was divided into six major areas, and the results will be reported accordingly.

Part I. General Information. This section pertains to a general picture of the type of school, its size, and the persons filling out the questionnaire. The person filling out the questionnaire form showed to some extent what persons in the school were particularly interested in the health program. In many cases, however, the principal filled out the form and undoubtedly may have regarded it as a routine matter. Combined figures of junior and senior high schools show in rank order the following major persons to have filled out the questionnaire: principal, physical education teacher, nurse, teachers (various), health co-ordinator, and vice-principal.

The size of the school is of interest, as it may affect the type of services and instruction received. However, this study would indicate that there are too many other variables to state that the size of the school plays a very important place in the health instruction picture.

Part II. School and Community Resources. The uses of community resources in the form of various agencies are not considered by the majority of the schools. The three agencies most frequently mentioned as assisting in the health instruction program are: Tuberculosis Association, Board of Health, and American Red Cross. Less than half of the communities have a health council and an even smaller percentage have any joint planning with home and school. Health services within the community are closely linked with the instruction program.

It was interesting to note the dearth of services available to the schools. For instance, only 142 schools either have a full-time, part-time, or consultant services of a dentist. There are only 113 nutritionists, either full-time, part-time, or consultants. Only 129 schools have a health co-ordinator, either full-time, part-time, or on a consultant basis. A health educator is only mentioned 36 times. Only 171 schools have a psychologist either full-time, part-time, or on a consultant basis, and yet many interviews showed mental health to be one of the pressing problems.

To summarize the above, it would seem that the schools are not availing themselves of the services of professional personnel to develop a well-rounded program of health services, and that frequently the lack of development is due to lack of administrative interest.

Part III. Organization and Administration of the Health Program. This study showed that the principal and the curriculum co-ordinator are the two persons who, more than others, supervise the health instruction program. It is interesting to note that there are only 17 health co-ordinators listed as supervising health instruction.

Only 26 per cent of the schools in this study stated that they had health committees. Where a health committee existed, it planned the school health program in only 41 per cent of the schools.

Sixty-six per cent of the schools stated that there is a required course in health. Courses frequently means a unit of work rather than a semester

course, as is the usual understanding of the word. The largest number (36%) have health one period per week; the next largest number (20%) have health as a block of time. In either case it is usually one day a week in another subject, or a block of time taken out of a regular academic subject. Roughly speaking, about a third to one-half of the schools require health instruction; the balance evidently do not require it, or the respondees did not know the requirements.

The title which is given to a course frequently designates to some degree the content which may be expected. The ten most frequently mentioned titles of health courses are as follows: First Aid, Health, Biology, Safety Education, Personal Living, Hygiene, Community and Social Health, Infant Care and Prenatal Care, Science, and Physical Education.

There are various ways in which health may be taught in the curriculum. It may be taught as a separate course, as units, or as incidental instruction. Table 2 shows how health is taught in the schools of this study.

There are also ways in which state requirements can be met. Table 3 shows how schools have fulfilled the new state requirement regarding First Aid and Life Saving.

Credit for health instruction is given either as part of physical education or as part of other courses. When separate health credit is given, the subject will then be on par with other subjects in the curriculum.

Part IV. The Health Instruction Program. This part is divided into three sections: (1) Time for Health Instruction, which includes the required courses, whether sex education is given, and what particular health problems are found in the school; (2) The Correlation of Health Instruction with other subjects and the units taught; (3) Materals Used in Health Instruction, which also includes teaching methods.

Time. Health is taught as a separate subject for one semester in 25 per cent of the schools. A little over half of the schools require health instruction for all students. Only 29 per cent of the schools stated that health is given only once a week as part of physical education, and yet 61 per cent stated that credit for health education was combined with physical education. This may mean that instruction may have been given both in physical education and in other courses, but that credit was combined with physical education.

The inclusion of sex education in this study means instruction, of course, but far beyond that it means a comprehensive and progressive process of education calculated to bring about the socially desirable adult attitudes and practices necessary to insure homemaking, the establishing and building of families. Results show that all students receive sex education in 26 per cent of the schools, but that certain classes receive sex education in 42 per cent of the schools. Many reasons for exclusion of sex education are very feeble, and many schools left this question blank, showing the reluctancy of the schools to face a controversial issue.

Nutrition is a very important subject and should receive considerable instructional time at all grade levels. In some of the interviews the need for

instruction in nutrition was brought out quite emphatically. The biggest problem seems to be the failure to eat breakfast and the consequent debilitating effect upon a growing organism. However, 76 per cent of the schools do not believe that malnutrition is a problem in the school.

Opinion questions in which the writer was attempting to get individual opinions as to the adequacy of the health instruction program showed that two-thirds of the schools do not think that health instruction is adequately taught. The wide range of problems shows the great individuality of the schools' health problems.

TABLE 1

Total Returns from the Questionnaire

Total number California secondary schools (1950-51)	Replies received		Replies not received	
	Number	Percentage	Number	Percentage
162 junior high schools	136	84	26	16
429 senior high schools	267	62	146	34
(Postcard replies only)	16	4		
591 schools	419	71	192	29

TABLE 2

How Health Is Taught in the 403 Schools Answering the Questionnaire

How health is taught	Number	Percentage
Health is taught as a separate course	62	15
Health is taught as units in various courses	295	73
Health is taught as part of physical education	306	76
Health is correlated with the entire curriculum	91	23
Blank	7	2

NOTE: Some schools may teach health in more than one way.

TABLE 3

How the State Requirement for First Aid and Life Saving Is Met in the 403 Schools in This Study

How the requirement is met	Number	Percentage
A special course	35	9
Time taken from physical education	246	61
Time taken from health course	49	12
Integrated into several subjects	91	23

NOTE: The required material may be taught in more than one way in some schools.

Correlation. There are three methods of teaching health instruction: direct teaching, correlation, and integration. Sixty-five per cent of the schools are attempting to correlate health instruction. This is a favorable report, and, if a sincere attempt is made, undoubtedly there is more correlation and integration of instruction going on in the schools than is possible to record on a questionnaire which is filled out by one or two members of a school.

Table 4 shows how various health topics are taught, whether by separate course or units in other courses, and the grade level in which they are taught.

TABLE 4

Units of Health Instruction: Joint Junior- and Senior-High School Report for 403 Schools

Unit of work	Section A		Section B							
	Separate health course	Unit in other course	Grade level where unit taught							
			7	8	9	10	11	12	13	14
Alcohol, etc.	52	303	77	114	146	175	142	139	4	3
Anatomy	32	197	40	42	70	108	120	76	5	6
Care of teeth	82	233	119	115	197	165	75	65	6	5
Care of nose and throat	85	193	86	72	144	172	68	64	3	3
Care of voice	68	150	82	89	112	107	53	53	2	1
Care of eyes	89	226	130	107	164	155	75	63	2	2
Care of ears	79	205	95	85	151	128	66	55	3	2
Care of Hair and skin	80	227	115	109	197	174	87	74	3	3
Child care	26	213	17	21	68	86	79	148	3	3
Choice of health adviser	17	21		3	11	16	21	28	3	2
Chronic diseases	35	152	12	13	30	106	59	70	3	2
Circulation	77	209	22	77	74	131	74	80	3	4
Clothing	33	253	62	95	131	140	84	70	2	2
Colds and influenza	79	212	67	91	112	154	79	73	2	1
Communicable disease	83	205	46	69	95	145	65	86	3	2
Community health	36	214	33	66	85	68	40	136	3	3
Disease prevention	83	207	34	73	86	135	69	101	2	2
Economics of health	28	119	11	12	43	40	22	98	2	1
Excretion—digestion	80	193	41	83	98	139	40	48	8	3
First aid	54	36	54	63	184	176	130	172	3	3
Fads, fallacies, etc.	33	200	21	63	68	57	66	121	2	1
Fatigue, rest, etc.	87	210	75	100	169	163	89	77	3	2
Family hygiene	30	177	4	5	33	45	48	151	3	3
Glands	81	141	24	18	36	132	58	73	3	2
Growth and development	74	180	29	56	80	123	62	81	3	3
Health examinations	75	169	110	98	163	116	94	101	2	2
Height and weight	71	190	113	97	142	133	54	67	1	1
Healthy environment	23	208	94	101	136	139	103	120	4	
Heredity and eugenics	36	221	7	49	35	70	60	129	4	3
Home nursing	19	197	49	12	62	71	109	112	2	2
Infections	75	182	19	66	127	152	69	66	2	1
Infant hygiene	12	116	5	5	40	59	54	83	2	2
Lighting	65	128	15	20	58	96	34	33	2	1
Medical progress	21	97	9	8	21	55	23	63	3	2

Unit of work	Section A		Section B							
	Separate health course	Unit in other course	Grade level where unit taught							
			7	8	9	10	11	12	13	14
Menstrual hygiene (girls)	32	204	72	59	134	99	96	110	2	1
Mental health	43	156	22	22	51	57	50	136	5	4
Nervous system	71	193	13	58	75	159	66	69	3	2
Nutrition and diet	84	225	84	82	162	141	76	81	2	2
Occupational health	20	76	8	12	17	49	22	38	2	1
Psychiatrics and guidance	16	99	8	7	24	39	26	89	4	2
Physical exercise	69	216	121	121	290	247	176	181	6	5
Personal hygiene	84	259	104	98	182	155	111	114	3	2
Posture	53	254	125	120	218	154	172	160	4	3
Physiology	43	152	14	16	42	120	92	79	4	4
Public health	37	151	12	15	49	89	92	143	3	2
Recreation	30	200	79	83	147	123	109	142	5	5
Respiration	76	192	19	66	105	167	84	84	3	2
Safety	43	267	90	79	171	195	105	124	4	4
Sanitation	65	188	62	65	113	118	81	67	3	3
Sex education	36	129	26	20	22	80	52	126	3	3
School lunches	50	115	25	62	53	82	42	37	4	3
Social problems in health	24	130	12	12	44	45	31	107	2	1
Ventilation	71	126	25	63	62	94	40	34	2	2
Vaccination (immunization)	80	169	67	69	115	123	60	48	3	1
Vocations in field of health	17	113	7	8	44	27	22	95	2	1

About 80 per cent of the schools use the various testing programs in the school to include incidental health instruction. This is in keeping with the theory that a testing program of any kind must have educational value if it is to be effective. One of the most natural subjects which may be correlated with health instruction is physical education; and it was found that health is correlated with physical education in 90 per cent of the schools.

Materials. The effectiveness of the health instruction will depend to a large measure on the materials used in the instruction program as well as the classroom methods. Courses of study are planned to assist the teacher in the selection of materials. Only 5 per cent of the schools used the California Course of Study. Preparation of the course of study by committee action is true in 40 per cent of the answers and shows some attempt at co-operation among school personnel. Only 4 per cent of the schools stated that the course of study was prepared by teachers and pupils.

There is a great variety in the selection of textbooks and undoubtedly this is a good sign that teachers are attempting to adapt the program to the particular situation. It was interesting to note in the interview with junior high school #268 that the principal felt that the California text was too difficult for the students to read. It is also interesting to note that many schools are

attempting to use more recent publications in teaching, and that pamphlets are receiving a fairly widespread use. Though many schools did not list the textbooks they are using, those schools which did answer this question list the four top books as follows: Clemensen and La Porte, *Your Health and Safety;* American Red Cross, *First Aid Manual;* Crisp, L. B., *Health For You;* and Wilson, C., J. Braken, and J. Almack, *Health Progress.* Numerous other books were mentioned.

The lecture method still seems to be the more popular method. Project method and problem solving are still not very extensively used in health instruction. The majority of the schools find visual aids effective. Socio-drama is still unfamiliar to the majority of teachers, which is unfortunate, as it lends itself very easily and effectively to health instruction material.

The availability of reference materials is very important if students are to develop and have opportunity of discovering information for themselves. Current health reference books and pamphlets are available in 80 per cent of the schools.

Part V. Evaluation of the Health Instruction Program. The problem of evaluation of health instruction is a very difficult one. We are not merely interested in testing knowledges, but must judge whether desirable attitudes and behaviors are also developed. The results show that 70 per cent of the schools used teacher-constructed health tests.

The observation of behavior is one of the more important forms of evaluating the effectiveness of health instruction. To do this, opportunities must be afforded for students to express learnings in overt actions. Most of the schools offer opportunity for students to participate in general campaigns of various volunteer agencies. Only 34 per cent of the schools allow the students to participate in planning student health council activities, and only 26 per cent have students assisting in health screening.

Part VI. Personnel Teaching Health Education. The most important single factor in organizing for health instruction in the secondary schools is the employment of a teacher trained in the health sciences and in health education to direct the program. This part of the study attempted to find out the educational preparation of the personnel, the major area of preparation, the teaching load and duties other than those of teaching health. This question was poorly answered. Undoubtedly, it was because the questionnaire was filled out by a person or persons who did not know the background of the teachers.

However, a few interesting points may be made. For instance, 43 per cent of those who filled out this part of the questionnaire have a Bachelor's Degree and 21 per cent have Master's Degees. Health, Physical Education, or Science seem to be the pretraining in the majority of cases. Most of the teachers have from one to five years' experience. The average teaching load is five or six hours per day, with one period a day of health teaching. Subjects other than health which are usually taught by the teachers are physical edu-

cation, science, or home economics. Most teachers have as other duties the coaching of athletics or sponsorship of school clubs.

Regardless of the pretraining of teachers and the present teaching activitives, there is need for continuous training, particularly in health. Forty per cent of the respondees stated that there was in-service training provided, and 33 per cent stated that it was not provided. Twenty-seven per cent were blank. Institute programs, lectures, curriculum groups, and workshops are the more popular forms of in-service training. Though 73 per cent of the teachers felt that special preparation was necessary to adequately teach hygiene, only 28 per cent felt that they were adequately prepared.

Conclusions

1. Health does not occupy a prominent position in the curriculum of California Secondary schools.

2. Health instruction is poorly organized as a subject area in the California secondary schools. There is great variance as to placement of health instruction in the total school curriculum; variance as to course content and grade placement; variance in teaching materials and methods; and variance in allocation of credit for health instruction.

3. Most schools still think the minimum of health services and State required courses, such as first aid, driver education, and safety education, as the extent of health education.

4. Controversial health issues are shunned by the school rather than the school assuming a position of leadership in the instruction of both students and community.

5. Supervision of health instruction is frequently performed by persons inadequately trained in this field.

6. Democratic principles of group planning are not commonly practiced in school health programs.

7. Evaluation of health instruction is still performed to a great extent by paper-and-pencil tests, with little attempt at concerted faculty evaluation of changes in students' attitudes and behavior.

8. Teachers of health instruction courses feel themselves to be inadequately prepared.

9. The schools are not fully availing themselves of opportunities for assistance from public and private health agencies to enhance the health instruction program.

10. Services of health specialists are available to select schools, particularly those in cities. Even when such services are present, the schools are not availing themselves of these services to the fullest extent.

11. Administrators, who control the health program to a large extent, are frequently disinterested and even antagonistic toward the subject.

12. State requirements in health instruction which are arbitrarily added to to the curriculum without revision of the total school curriculum, have an-

tagonized administrators in many instances, and have led to poorly planned programs of health instruction.

Suggestions for Further Study

1. A study of the school curriculum should be made to ascertain wherein integration and correlation of health instruction can best be made.
2. Grade placement of instructional information in health education is indefinite and needs further study.
3. A study should be made to suggest methods for overcoming community prejudices to the teaching of controversial health issues in the schools.
4. A study should be made to determine the amount of pretraining physical educators should have in health education, and specifically health examinations.
6. A study should be made of workshops and summer session offerings in health instruction to discover whether they are meeting the needs of persons teaching health courses at the secondary level and whether they are stressing and giving practice in democratic teaching methods.

(Submitted 4-15-53)

Preparation of Teachers of Health in Minnesota

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THE PREPARATION OF individuals teaching health in secondary schools has long been a topic of discussion and debate among educators and health workers. Little or no concrete evidence has been available to substantiate arguments that teachers of health were or were not well qualified. The present study[1] was undertaken to determine what formal preparation had been obtained by persons teaching health in Minnesota high schools in May 1952 in selected basic health sciences, personal and community health, and school health education.

In addition, this study attempted to obtain information on several other points, including the number of Minnesota secondary schools that offered health courses in the curriculum, extent to which credit was given for health courses, total teaching load of health teachers, and percentage of teaching load devoted to health teaching.

Background of the Study

Efforts have been made on state and national levels to recommend the kinds of training and the competencies that secondary school health teachers should have. These recommendations are in rather general terms. Since titles of courses vary from one institution to another and because of the principle of institutional autonomy, state and national committees hesitate to delineate the exact courses that health teachers should take (3, *p. 1*).

The Minnesota Department of Education, with the assistance of a committee of teacher training personnel, has developed "Recommended Minimum Standards for the School Health Education Teaching Minor in Minnesota (7). These recommendations include 10 to 14 semester hours or 15 to 21 quarter hours in basic health sciences, 4 to 6 semester hours or 6 to 9 quarter hours in theory in school health education, and 1 to 3 semester hours or 2 to 4 quarter hours in student teaching and field experience.

Schools wishing membership in the North Central Association of Colleges and Secondary Schools are required to complete various evaluation schedules, among which is *Health and Safety* (4). Part IV of this schedule deals

[1]A study of the professional preparation of individuals teaching direct health classes in Minnesota junior and senior high schools (exclusive of Minneapolis, St. Paul, and Duluth schools) in May, 1952, as a part of the requirements for the degree of Master of Public Health at the University of Minnesota.

with the preparation of teachers who have responsibility for organized courses in health or safety instruction.

One of the most significant events in the area of teacher preparation for health education was the National Conference on Undergraduate Professional Preparation in Physical Education, Health Education and Recreation, which was held at Jackson's Mill, Weston, West Virginia, May 16-27, 1948. The purpose of this conference was to improve undergraduate professional preparation. The report of this conference delineates the knowledge, skills, and attitudes a health teacher should have, and indicates learning experiences that might be provided by teacher training institutions (3, *p. 11-13*).

Scope and Method of the Study

The background training for health teachers recommended by these state and national leaders seem to fall into three general categories: basic health sciences, personal and community health, and school health education—methods, materials, principles, and organization and administration. A one-page questionnaire was constructed to determine the number of semester hours of undergraduate and/or graduate work Minnesota health teachers had had in these three areas.

In order to get an adequate sample, it was decided to survey the 453 teachers in Minnesota schools who were teaching more than one hour a week of direct health classes in May 1952.

To pretest the questionnaire, a pilot survey was conducted. The questionnaire was sent to ten health teachers who were personally known by the author in order to: (1) determine whether the questions or any other items in the questionnaire were ambiguous; (2) determine whether some items of importance were omitted; and (3) get suggestions from these teachers for improving the questionnaire and to point out its limitations. All the ten teachers completed this questionnaire and made valuable suggestions for changes and additions. These suggestions were incorporated into the form used in the survey.

This study was carried out by a member of the state health department staff. To add status and prestige, the letter accompanying the questionnaire form was on the letterhead of the State Departments of Health and Education and carried signatures of representatives of both these agencies. To encourage a greater return of questionnaires a self-addressed stamped envelope was included with the questionnaires and the letter of explanation. A total of 360 of the 453 health teachers who were surveyed returned the completed questionnaire. This number represents a return of 79.5 per cent.

The questionnaire method, of course, has very obvious limitations. There is difficulty in getting a large enough return so that the sample obtained gives a fairly accurate picture. The second limitation is that the information obtained is what the respondent *says* or *thinks*. It may be conjectured that errors in reporting were probably those of commission rather than of omission. Since the questionnaire was searching for courses which the person had

had to prepare himself for health teaching, the respondent was apt to say he had had more semester hours or more courses than he actually had had.

Findings

Colleges Represented and Degrees Earned. It was found that 55 different teacher training institutions had a part in the training of Minnesota health teachers. This number represents 20 Minnesota institutions and 35 located in other states. Although the greater number of these colleges and universities are outside Minnesota, only 75 of the teachers (21%) were trained in them. Minnesota institutions trained 285 (79%) of the teachers. These figures indicate that the teacher-training problem in Minnesota is largely its own.

A total of 335 health teachers (about 93%) had undergraduate degrees and 28 of these (about 8%) had graduate degrees. Although a Bachelor's degree is considered a requisite for certification for secondary teaching in Minnesota, 25 (about 7%) of all Minnesota health teachers responding in this study indicated they had not earned a degree.

There were 28 additional teachers with undergraduate degrees who had taken graduate work beyond the Bachelor's degree but not enough to satisfy the requirements for the Master's degree.

Major and Minor Felds of Minnesota Health Teachers. To determine in a general way, the background preparation of persons teaching health courses in Minnesota schools, respondents were asked to indicate their major and minor fields. These were extremely varied. A total of 25 different major fields and 34 different minor fields were represented.

A major in physical education was reported by 234 (65%) of the health teachers, while 63 more (about 17.5%) had a minor in physical education. Combining the majors and minors, we find that a total of 297 (82.5%) of Minnesota health teachers had majors or minors in physical education.

The next largest number of majors and minors were found in the area of social studies. A major in social studies was reported by 53 (almost 15%) of the health teachers, while 80 (22%) had minors in social studies; hence, 133 (about 37%) of the health teachers held majors or minors in this field.

It should be pointed out that social studies are frequently taken in combination with physical education. Of the teachers responding in this study, 72 had a major in physical education and a minor in social studies, 30 had a major in each of these fields, while 25 had a major in social studies and a minor in physical education.

The next largest number of majors and minors were in history. Here we find that 25 (about 7%) of the health teachers had history majors and an additional 63 (17.5%) had minors in history; thus, 88 or 24.5% of health teachers had majors or minors in history.

The fourth largest number of majors and minors were in English. There were 27 (7.5%) who had English majors and 44 (12%) who had English minors. This represents a total of 71 health teachers (about 20%) who had majors or minors in English.

Majors and minors in health were in fifth place. Only 25 (7%) had majors in health, and only 43 (12%) had minors in this subject. This makes a total of 69 (about 19%) of the 360 Minnesota health teachers who had majors or minors in health at the time of this study.

When we break down the training of health teachers in terms of their majors alone, we find the following major fields represented (in rank order): Physical Education (234); Social Studies (53); Biology (28); English (27); and History and Health (25 each). Beyond these first six ranking majors, we find that health teachers have majors in 19 other fields. In terms of minors, we find Minnesota health teachers with the following (in rank order): Social Studies (80); Physical Education (63); History (63); English (40); Health (43). In addition to these five top-ranking minors, Minnesota health teachers had minors in 29 other fields.

Committees of national education and health associations have indicated that certain courses required of teachers of biology, general science, social science, home economics, and physical education provide valuable background training for health teachers (5). We note that physical education, biology, and social science appear in each of our lists above; however, these committees do not consider English and history desirable areas of concentration for health teachers.

It is also interesting to note the great number of health teachers who had double majors or minors, such as Physical Education and Social Studies. It was found that 113 health teachers had double majors while 247 indicated that they had single majors. A total of 171 had double minors, while 157 had single minors.

It should be pointed out that a few Minnesota teacher-training institutions offer a *combined* major in health and physical education. In this report, this *combined* major is counted as a *double major*, i.e., the same as if an individual had a major in Health and another separate major in Physical Education. In the case of the combined Health and Physical Education major, the student is also required to have at least one minor; this is not the case where a student is able to earn two separate majors.

Semester Hours of Credits Reported in Specific Areas. To determine more specifically the preparation of Minnesota health teachers, the questionnaire attempted to elicit the number of semester hours' credit that health teachers had earned in basic health sciences, personal and community health, and school health education. In addition to the specific courses listed on the questionnaire form, provision was made to encourage those surveyed to list other courses they had had which added to their ability to teach health.

1. *Basic Health Sciences*

Table 1 shows the number of semester hours reported by Minnesota health teachers in selected basic health sciences.

TABLE 1

The Number of Minnesota Health Teachers Reporting Courses in Selected Basic Health Sciences (May 1952)

Subject	Semester Hours' Credit												
	0	1	2	3	4	5	6	7	8	9	10	11	12	12+
Anatomy	87	10	31	163	43	8	8	1	5	1	0	0	1	2
Bacteriology	308	2	10	24	10	0	4	0	1	0	1	0	0	0
Nutrition	300	10	14	21	10	1	1	3	0	0	0	0	0	0
Human Physiology	105	5	32	140	33	16	15	4	7	1	0	0	2	0
Kinesiology	136	19	61	118	17	3	5	1	0	0	0	0	0	0
Human Biology	192	6	24	54	27	14	18	8	16	1	0	0	0	0
Zoology	166	3	21	34	26	14	17	11	59	2	2	1	3	1

From this table it is apparent that Minnesota health teachers were not too well grounded in the basic sciences enumerated. We find the greatest number of teachers reporting credit in the courses usually required of physical education majors. Anatomy, human physiology, kinesiology, and zoology are the courses which most health teachers had had; however, 87 or 24% reported no semester hours' credit in anatomy, 105 or about 30% reported no credit in human physiology, 136 or 38% none in kinesiology, and 166 or about 46% none in zoology. Bacteriology, nutrition, and human biology are other courses considered desirable for preparation of health teachers, yet 308 (86%), 300 (83%), and 192 (53%), respectively, of teachers answering the questionnaire indicated they had not had courses in these subjects.[2]

2. *Personal and Community Health*

Table 2 presents the number of semester hours reported in personal and community health courses.

In general, we can conclude from this table that these teachers have not had adequate training in Personal and Community Health. The course reported most often was First Aid. Study in this area is recommended by many experts for *all* teachers, yet we find that only 58 per cent of Minnesota health teachers reported preservice preparation in first aid. In so important an area as Elements of Preventive Medicine, we find that only 21 teachers (about 6%) of the 360 responding reported formal preparation in this subject. Extremely low proportions were also found for the other courses listed.

3. *School Health Education*

The third general area surveyed dealt specifically with courses in school health education — methods, materials, organization, and administration. Table 3 presents the findings in this area.

[2]At some teacher training institutions, human biology may be substituted for zoology.

TABLE 2

The Number of Minnesota Health Teachers Reporting Courses in Personal and Community Health (May 1952)

Subject	Semester Hours' Credit						
	0	1	2	3	4	5	5+
Personal Health	209	36	44	59	8	0	4
Health Problems of the Community	300	8	25	23	4	0	0
Personal and Community Health	264	12	42	34	4	0	4
Community Hygiene	294	11	30	21	3	0	1
Community Health Education	326	6	12	16	0	0	0
Mental Hygiene	285	21	20	28	5	0	1
First Aid	150	77	74	50	6	0	3
First Aid (Instruct. course)	273	27	38	16	4	1	1
Principles and Methods of Community Health Education	292	8	22	35	3	0	0
Health Care of the Family	344	3	6	6	1	0	0
Elements of Preventive Medicine	339	3	10	7	0	1	0
Red Cross Home Nursing	348	7	3	1	0	0	1

From Table 3 it is apparent that a great majority of Minnesota health teachers were never exposed to the specialty courses in school health education that would prepare them for teaching in this area. We find only 102 teachers (28%) who had preparation in Methods and Materials of Teaching Health and 123 teachers (34%) who had preparation in Organization and Administration of the School Health Program. Another very significant shortcoming in teacher preparation for health teaching is indicated by the small number who had had student teaching in this area. Only 42 (about 12%) of the 360 teachers responding in this study indicated any supervised teaching in health.

One other area is worthy of special attention. In the case of Health of the School Child, which is a course required of all education majors in some teacher training institutions, only 48 teachers (about 13%) reported that they had had instruction in this subject.

4. *Miscellaneous*

Space was provided on the questionnaire to encourage respondents to indicate courses they had had, other than those named, which they felt added directly to their preparation for health teaching. A great number of different courses were listed, but most of them either had no direct relation to health

TABLE 3

The Number of Minnesota Health Teachers Reporting Courses in School Health Education (May 1952)

Subject	Semester Hours' Credit						
	0	1	2	3	4	5	5+
Health of the School Age Child	312	8	30	9	0	0	1
Problems in the School Health Program	313	7	19	16	4	2	1
School Health Education	267	13	35	41	1	0	1
Student Teaching in School Health	318	15	11	13	3	0	0
School Health Instruction	337	3	11	9	0	0	0
School Health Instruction (advanced)	351	3	2	4	0	0	0
School Health Education Seminar	346	1	6	7	0	0	0
School Health Education Program	327	5	14	11	3	0	0
Principles and Problems of Teaching Social Hygiene	316	10	21	11	1	0	0
Methods and Materials of Teaching Health	258	7	42	53	0	0	1
Organization and Administration of School Health Program	237	9	49		6	2	4

or they probably could have been included under courses in the body of the questionnaire.

Extent of Health Teaching in Minnesota. About half (50.5%) of the health teachers taught either two, three, or four health classes a week. Another 41 per cent taught five to ten classes a week. The remaining 8.5 per cent taught health 11 to 25 classes a week.

Although over half the schools in Minnesota have two or more hours of health instruction a week, health teachers in general were spending a major portion of their time teaching in other areas. Only three health teachers had substantially a full-time health teaching load at the time this study was made, and only 8 per cent of health teachers were spending more than 50 per cent of their total time teaching direct health classes.

We might conclude that there is only a small amount of direct health instruction in Minnesota schools at present. This is true when one compares the time given to health teaching with the time given to teaching in other curriculum areas. However, when we realize that in 1940-41 almost no direct health instruction was found in Minnesota secondary schools, there is relatively a considerable amount today.

In a study conducted by the state supervisor of health, physical education, recreation, and safety of the Minnesota Department of Education (9), it was found that only three men who had majors or minors in physical education taught direct health classes in 1940-41, while a similar study taken from the 1950-51 high-school teacher qualification reports found that 163 men teachers who had majors or minors in physical education taught direct health classes (10). We note that among Minnesota health teachers, 82.5% had either a major or a minor in physical education.

The commission on health in schools in its publication, *Health in Schools* (1, *p. 167*) makes the following statement regarding direct health instruction in the secondary school:

> "Two concentrated coursess, one semester in duration, are recommended—one in the ninth or tenth grade, the other in the eleventh or twelfth. Another semester also is urged in the seventh or eighth grade, if health units are not planned in other subject.."

The trend is toward including more direct health instruction at the secondary level. If this trend continues, the next generation may witness the realization of the above widely-accepted recommendation.

Summary and Conclusions

The findings in this study indicate that, in general, Minnesota health teachers are not well qualified. More schools are adding direct health courses to their curricula each year; consequently, there is an ever-increasing need for more qualified health teachers. This situation presents a challenge to teacher-training institutions to examine their curricula to determine whether their graduates are being adequately prepared to assume their health teaching responsibilities in our schools.

This situation also demonstrates the need for more intensive in-service training programs for health teachers now on the job, a challenge which should be considered by local school systems, teacher training institutions, the State Department of Education, the State Department of Health, and other agencies concerned with improving the school health education program.

REFERENCES

1. American Association of School Administrators. *Health in Schools.* Revised edition. Washington, D. C.: the Association, a department of the National Education Association, 1951. 477 pp.
2. Athletic Institute. *A Report of the Graduate Study in Health Education, Physical Education, and Recreation.* Chicago 4: the Institute, January 1950. 31 pp.
3. ———. *A Report of the National Conference on Undergraduate Professional Preparation in Health Education, Physical Education, and Recreation.* Chicago 4: the Institute, May 1948. 40 pp.
4. Cooperative Study of Secondary-School Standards. *Evaluative Criteria,* Section D-7, *Health and Safety.* Washington, D. C.: The American Council on Education, 1785 Mass. Ave., N.W., 1950. 8 pp.
5. Kleinschmidt, Earl E. *Opportunities for the Preparation of Teachers in Health Education,* Bulletin No. 1. Washington 25, D. C.: U. S. Office of Education, 1942. 117 pp.

6. MOORHEAD, JENNELLE. What Is the Training of Health Teachers in Oregon High Schools? *Journal of School Health*, XII: 4, 1952. pp. 95-101.
7. MINNESOTA DEPARTMENT OF EDUCATION. Bulletin, *Recommended Minimum Standards for the Health Education Teaching Minor in Minnesota.* St. Paul 1: the Department, undated, Code XIV-B-179C. 1 p.
8. NATIONAL EDUCATION ASSOCIATION AND AMERICAN MEDICAL ASSOCIATION. Joint Committee on Health Problems in Education, *Health Education.* 4th edition. Washington 6, D. C.: National Education Association, 1948. 413 pp.
9. SANDELL, PERRY J. *A Study Taken from 1940-41 High School Teacher Qualification Reports of All Men Who Have Either a Major or a Minor in the Field of Physical Education, and All Men Who Are Teaching Physical Education. The Study Indicates the Amount of Time Each Man Spends Teaching Per Week in the Various Subjects and Activities Indicated. This Study Does Not Include Cities of the First Class (Minneapolis, St. Paul, and Duluth).* St. Paul 1: Minnesota Department of Education, undated, unpublished study. 6 pp.
10. ———. *A Study Taken from 1950-51 High School Teacher Qualification Reports of All Men Who Have Either a Major or a Minor in the Field of Physical Education. The Study Indicates the Amount of Time Each Man Spends Teaching Per Week in the Various Subjects and Activities Indicated. This Study Does Not Include Cities of the First Class (Minneapolis, St. Paul, and Duluth).* St. Paul 1: Minnesota Department of Education, undated, unpublished study. 6 pp.

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Landing Force in a Portable Collapsible Jumping Pit Compared with that in Conventional Jumping Pits

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A PORTABLE-COLLAPSIBLE pole vaulting and high jumping pit shown in Figures I and II was developed to solve some of the problems that are involved in the administration of the high jumping and pole vaulting events of track and field athletics.[1] The basic problem, of course, is to prevent injury to the pole vaulters who are dropping from increasingly greater heights. Because the literature failed to reveal any investigations dealing with the force of landing in various landing mediums for the high jump and pole vault, this study was initiated.

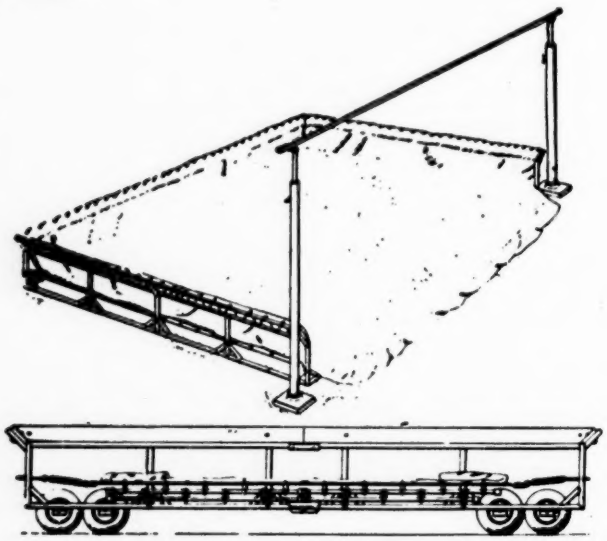

FIG. 1. A perspective view of the jumping pit, showing it in a set-up position ready for use in a pole-vaulting or high-jumping event. (*upper drawing*)
FIG. 2. A side elevational view of the jumping pit. (*lower drawing*)

[1]This pole vaulting and jumping pit was developed by Robert W. Henderschott.

The purposes of this study are: (1) to investigate whether this portable-collapsible pit is superior to other types of landing pits in terms of lessened shock of a 20-pound sandbag falling from a height of ten feet; and (2) to determine whether these differences are large enough to be significant. The investigation is based upon the assumption that if significant differences are found in lessened shock of a sandbag landing in a portable-collapsible jumping pit then relatively similar findings would be revealed if an athlete were substituted in place of the sandbag.

Procedure

The device used for measuring the landing shock in the various pits is pictured in Figures III and IV. It consisted of two compression springs mounted upon a special iron frame, which were able to stand a 3,000-pound jolt and which had a compression range of three to six inches. To these springs was welded a metal plate which formed the base for a detachable, wooden drop board. At the top of the iron frame was a graduated recording gauge for recording measurements of the landing force of the 20-pound sandbag from a height of ten feet.

A special rotating, universal joint attached to the back of the drop board solved the problem of an indirect hit by the sandbag on the drop board. The recording hand on the face of the recording gauge was governed by a *C*-lever, so named because of its shape. The *C*-lever was attached to the universal joint in such a manner that a wire running to the hands of the recording dial permitted a direct registration of the force of the sandbag each time it was dropped. After each drop was made, the hands of the recording dial had to be reset before the next drop of the sandbag was made.

To insure that the sandbag would land as near the center of the drop board as possible, two guide ropes were rigged from the frame of the device to the supporting beams of the roof of the building. A special device for releasing the bag was used and required only a slight pull on a release rope to trip the mechanism.

After each drop of the sandbag was made, the hands of the recording dial had to be reset before the next drop. The landing mediums for the different pits were kept at a constant 18-inch level in depth. Before each drop, the height of the bottom of the sandbag above the drop board was measured by means of a metal pole exactly ten feet in length. After each drop the device was moved and the landing medium was either forked over or spaded to keep it soft and its level constant.

After each series of 25 drops, the sandbag was removed from the testing area and weighed to insure that its weight remained exactly at twenty pounds.

Administration of the Measurements

The landing mediums and jumping pits tested were: (1) a dirt pit similar to the pits which were constructed before the advent of the present-day conventional type jumping pit; (2) the conventional type jumping pit; and (3) a portable-collapsible jumping pit. The landing mediums in the conventional

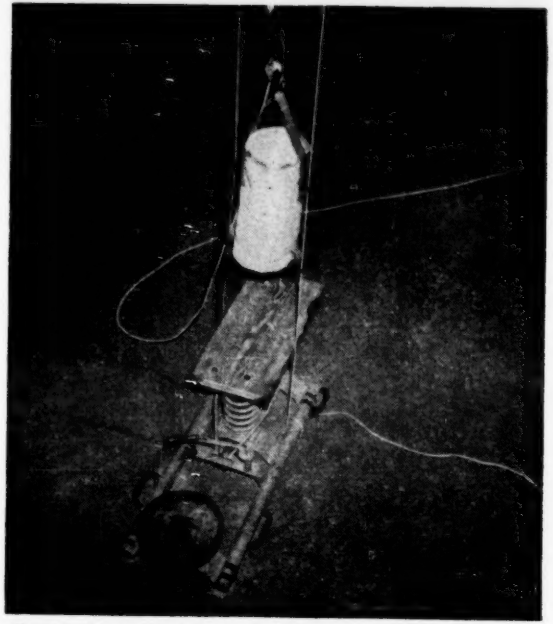

FIG. 3. A perspective view of the device used to measure landing shock.

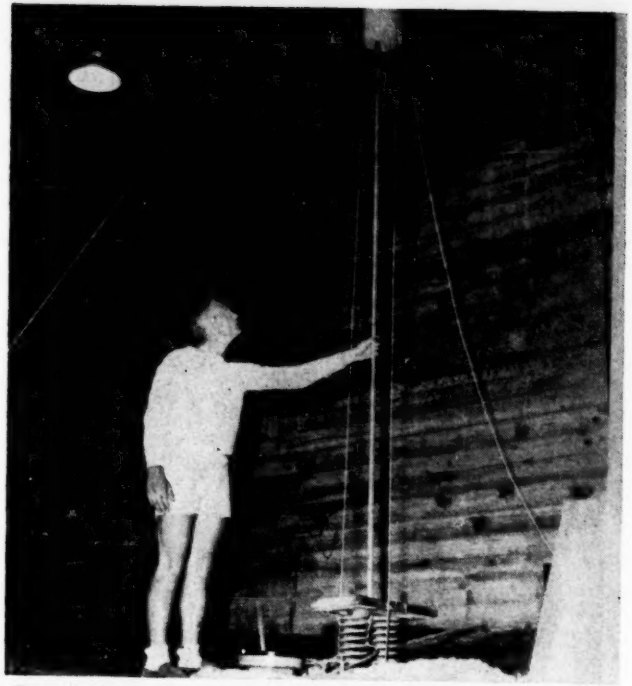

FIG. 4. A side view of the shock-measuring device, showing the method used to measure the height of the sandbag.

pit and the portable pit were dry wood shavings. The dirt pit, with a mixture of clay and loam, was a spaded area of approximately three feet by five feet. The 20-lb. sandbag was dropped 50 times into each type of pit.

For the purpose of first establishing the reliability of the measuring device, a series of 258 drops of the sandbag was made in a conventional jumping pit. A reliability coefficient of .870 was obtained by correlating the scores from alternate drops, 129 of each. This reliability coefficient is high enough to meet the requirements for the self-correlation of a physical test (1).

Results

Table 2 reveals that the force of fall of the sandbag was 82.1 pounds or 15.1 percent less in the portable pit than in the conventional pit. The force of fall of the sand bag was 92.1 pounds or 14.5 per cent less in the conventional pit than in the dirt pit. The force of fall of the sandbag was 174.2 pounds, or 27.4 percent less in the portable pit than in the dirt pit. These differences were all found to be significant within the 1-per cent level of confidence as revealed by the *t* values of the differences between landing shock in each of the three types of pits. These findings therefore reveal that the landing shock in the portable-collapsible pit is significantly (2) less than in a conventional shavings-filled jumping pit or in a spaded dirt pit.

TABLE 1

Ranges, Means, and Standard Deviations of Scores from Fifty Drops of the Sandbag in the Dirt Pit, Conventional Pit, Portable Pit and onto the Dirt Floor

Jumping Pits	Range	Means	σ
Portable pit	325-550	460.9	64.880
Conventional pit	425-650	543.0	63.015
Dirt pit	500-725	635.1	46.930
Dirt floor	650-775	722.2	20.470

TABLE 2

Differences and Significance of the Differences Between the Three Types of Landing Pits

Mean of dirt pit	Mean of conventional pit	Mean of portable pit	Difference between means	*t*	Difference in percent
(Pounds)	(Pounds)	(Pounds)	(Pounds)		
	543.0	460.9	82.1	6.334	15.1
635.1	543.0		92.1	8.208	14.5
635.1		460.9	174.2	15.229	27.4

REFERENCES

1. Garrett, Henry E. *Statistics in Psychology and Education.* New York: Longmans, Green and Co., 1926, p. 269.
2. Smith, G. Milton. *A Simplified Guide to Statistics.* New York: Rinehart and Co., Inc., 1946, p. 59.

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Job Analysis in Health, Physical Education, and Recreation

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ALTHOUGH THE TERM "job analysis" is a comprehensive one, its application to the educational field has been aptly described by Charters. He points out that:

> "Job analysis is a term of doubtful respectability to which exception is taken in some educational circles. It smells of sweat and dirty hands; or so it appears to many educators who look upon job analysis with some disgust. Job analysis appropriately associates with bricklaying so some of the educators say; and it can have no relation of a worthy sort with professional analysis or the analysis of ideals or with culture. Therefore those of us who associate with job analysis have invented synonyms with fewer low associations and speak of activity analysis, trait analysis, occupational analysis, functional analysis, and the like. But they are all members of the same tribe and are descendants from Old Chief Job Analysis" (3, *p. 44*).

In recent years, leaders in the fields of health, physieal education, and recreation have expressed the importance of analyzing the duties of workers in these areas. The Research Council of the Research Section of the American Association for Health, Physical Education, and Recreation has endorsed this type of research by stating that the importance and application of job analysis studies in the fields of health education, physical education, and recreation are obvious" (20, p. *338*).

For the most part, the final purpose of job analysis is to find ways to improve the actual work on the job. Proponents of this research method agree that this objective can be reached, at least in part. This can be done by using data resulting from studies which analyze the functions of workers in health, physical education, and recreation to devise courses of instruction.

Purpose

It is the purpose of this report to review several studies of a job analysis nature in the area of health, physical education, and recreation which have appeared in the literature in past years. No attempt has been made to exhaust the literature with regard to this type of research. On the other hand, the studies reviewed here give a sampling of the scope, purpose, and techniques employed in this method of research in health, physical education, and recreation. It is hoped that this information will serve as a rough guide for persons wishing to pursue this type of research in these fields.

Review of Research

Job analysis studies in the fields under consideration were preceded by sim-

ilar studies in industry. In this connection, it may be advisable to consider the relationship of industrial job analyses to those in the field of education.

Probably one of the first job analysis studies in the educational field was one made by Koos and Woody (15). In the spring of 1917, they launched an investigation with the intent of obtaining facts which would be of use in helping to determine the preparation to be given high-school teachers in training. Two questionnaires were sent out, one to teachers asking them to report the actual preparation they had had for their work, and the other to superintendents asking them to indicate the minimum amount of training such teachers should have in order to meet adequately the needs of the school system. The purpose was to find out the number of school subjects taught, subject combinations, and hours of preparation in subjects taught. Although these investigators showed to some extent what might be done with job analysis in the educational field, they did not investigate the duties of the teachers.

Some years later Koos, in discussing this study, attempted to show where there was a difference between job analysis in industry and the educational field. His comments follow:

> "The report of our study of almost 500 teachers in the high schools of Washington made its appearance in the Eighteenth Yearbook of the National Society for the Study of Education. We subsequently recognized that we had made what in some important respects was a venture in job analysis.
>
> "Anything like a full consideration of the problem, however, makes clear the fact that we shall not get far without, in addition to modifying the training to fit the job, at the same time modifying the job. This is where we must break with the job analyst in industry. I find among the job analysts in industry no suggestion that the job may not be just as it should be. The assumption seems to be that whatever is in industry is right" (14, *p. 228*).

One of the early studies appearing in the literature which concerns the duties of physical educators is the work of Monroe (17) who studied the duties of physical directors and athletic coaches in high schools. Two thousand questionnaires were sent out to 725 cities with a total of 1,032 completed questionnaires included in the final tabulations. Seven questions out of the total of 16 were intended to secure information not related to actual duties.

In making the study the author pointed out that there was no attempt to solve any problem, but that the information collected might be useful to those persons planning curricula in schools or departments of athletic coaching. It was further mentioned in this connection that the information presented related to existing conditions and that it should not be assumed that it would be desirable to perpetuate these conditions. This bears out the statement of Koos referred to previously regarding the difference in job analysis in industry and job analysis in the field of education. That is, it might be necessary to modify the job, in addition to modifying the training to fit the job. Furthermore, it brings out the importance of working with selected participants who are carrying on the best practices in the field, rather than using

a random sampling of individuals without establishing criteria for their participation.

Bartlett and Boyd (1) analyzed the activities of the Young Men's Christian Association Executive Secretary for the purpose of obtaining factual material upon which to build programs of training. Twenty-one of the Chicago Executive Secretaries were observed individually for approximately a week each and activities performed by them were carefully recorded.

The validity of the observer technique, according to these authors, is dependent upon the following factors:

1. Co-operation of the one observed.
2. Ability of the observer to identify and record accurately the activities of the observee.
3. Extent to which the observee acts normally when his actions are being watched.

The authors also were of the opinion that the greatest limitation of the observer technique is the length of time necessary to cover a number of cases, since only one person can be observed at a time.

In a companion study of the duties of the Young Men's Christian Association Physical Director, the same authors (2) attempted to collect material which would be helpful in establishing a training program which would suit the needs of YMCA directors in the field.

The investigators employed the memory or "dragnet" technique of discovering the duties. This consisted of issuing a data blank on which the people under study were requested to list all the activities they performed in their position. Recollection was stimulated by such leading statements as:

1. List everything that has to do with your work for one typical day.
2. List duties that you perform occasionally.
3. List duties you perform at a special time, holidays, etc.

There were 1,704 possible activities collected and they were composed into a master list. This master list was submitted to 574 physical directors and returns were received from 26 states, representing different-sized associations and including physical directors of different ages, training, and experience. The duties were rated with regard to frequency of performance, difficulty in learning, importance of the duty, and the need for school training in the duty. Although the master list was developed primarily for the purpose of securing a rating of the activities by physical directors in the field, the investigators pointed out that the master list contained extremely important values in itself. Some of these values include:

1. A description of the job.
2. A useful guide for aspirants to the physical directorship.
3. A check list whereby physical directors may compare their operations with those of others in the same work.
4. A means of explaining to volunteer workers the points at which their services may be effective.

Neilson (18) conducted a study pertaining to the work of physical educators. The first step was the convening of a seminar of 12 persons. The

participants represented different types of teaching and administrative positions in boys and girls physical education in the two California cities, Berkeley and Oakland. The problem was explained to the seminar and the 12 members returned to their positions and kept a record for two days of everything they did in connection with their jobs.

The same group convened in a second seminar and analyzed and classified the reports into 18 types of duties. The participants then kept a record of every duty performed for six teaching days and arranged these in frequency under the various classes of duties. These data were not included in the report of the study. However, the author mentioned that the results revealed some interesting facts, and pointed out further that the study showed that job analysis, applied to the field of physical education, could be of value in solving many problems.

Charters and Hindman (6) made a study of the duties of the Public Health Commissioners of Ohio. The major purpose of the study was to provide the basic information upon which a curriculum for the future training of public health commissioners could be selected. The first stage in this study was the identification of the duties of the position, and this was done by a careful review of the professional literature. The authors pointed out that this technique was used because the information was easy to locate and because articles appearing in the literature dealt by implication, not only with the activities of public health commissioners, but with those which were believed by the persons who wrote upon the topics to be both important and difficult enough to be worthy of discussion.

Eleven hundred duties were gathered from the literature and were placed in both a structural and functional classification. The structural classification concerned the objects or nouns with which the commissioner worked; the functional classification used the verbs as major headings. A "crosshatch" treatment of verbs and nouns revealed a total of 10,121 hypothetical possibilities of duties. Assuming theoretical completeness after this treatment, an evaluation for range of performance was conducted. This was done by holding a mass interview of the Public Health Commissioners of Ohio. Everyone present was asked to check the master list which meant making some 10,000 judgments in a period of three hours. In this connection, the investigators mentioned that the participants, to have made superior judgments on the 10,000 items, should have worked six hours at intervals to safeguard against fatigue.

In this study the authors pointed out that those duties which should have a preference in curriculum are those which occur most frequently, are most difficult, and are of greatest importance.

Shepard (21) conducted a study with the idea of making a modified job analysis of the department heads of boys physical education departments in the senior high schools of the Los Angeles area. A checklist was submitted to 27 department heads of schools ranging in enrollment from 400 to 3,600 pupils. The checklist contained 40 items pertaining to professional training

and experience, and 206 items dealing with administrative and supervisory duties in relation to both the general physical education and athletic programs.

Of the 206 items classified as duties pertaining to administration and supervision, it was found that 175, or 85 per cent of the total number, were performed by more than 51 per cent of the workers with sufficient frequency to be classified as common duties.

In attempting to determine the teacher activities which the graduates of the physical education curriculum must be able to perform in their teaching, Hindman (9) made a study of teaching activities concerned only with physical education.

The activities were selected by reviewing the literature and the following four sources were examined:

1. Teacher activities given in the Commonwealth Teacher-Training study (7).
2. Bartlett and Boyd study of the YMCA Physical Director (2).
3. Monroe study (17).
4. J. H. McCurdy bibliography (16).

A total of 710 items were collected and these were telescoped into 330 items and arranged under 35 headings. This list was submitted to teachers in the field, so that they might add to it. Seventy-seven physical education teachers in the secondary schools of the State of Ohio were asked to check the list of 330 activities and to add to it. Of the 77 lists sent out, 62 were returned; these contained a number of suggestions for lengthening the list. In addition, five members of the physical education staff of Ohio State University checked the list, along with the secretary of the department, the athletic trainer, and five graduate students. In all, 74 people examined the list for thoroughness.

Two hundred and fifty-four suggestions for additions to the list were made but most of these proved on examination not to be new at all but were already represented in the list. In some cases the new statements were telescoped with the old. A new master list was developed which contained 341 items as compared with 330 items of the original list. However, only ten of these were new and 49 were restated.

At this point six members of the staff of the Ohio State University Department of Physical Education evaluated the activities with a view to deciding whether or not they should be included as specifications for the curriculum in physical education. Each person was asked to evaluate the activities with the following question in mind: "In attempting to achieve the objectives agreed upon, how important is it that a good teacher of physical education in a high school of Ohio shall be able to perform this activity?" After an activity had been evaluated with the above question in mind, the person was asked to consider the same activity with the following question in mind: "In view of its range of performance and in view of my opinion of its importance, how necessary is it that physical education teachers receive pre-service training in the performance of the activity, rather than depending

on learning that activity on the job?" The six members of the faculty rated the activities in this way in order to determine whether or not they should be included in the curriculum for training physical educators at the Ohio State University.

Charters and Frye (4) in studying the duties of recreation workers compiled a list of duties from the literature in the field and then submitted the list to practitioners for supplementation. In regard to the use of this checklist, the investigators stated that:

> "It is extremely difficult for any person to indicate the duties of a worker, desirable skills in performing jobs or similar assignments unless he can consult some sort of a check list to use as a guide. With such a list a more adequate expression of his opinion can be obtained" (4, *p. 14*).

They pointed out further that:

> "The activity analysis method provides a convenient process for resolving a complex situation into elements that may be synthesized in their relation to some definite objective. Once the elements or activities are determined, they provide a convenient instrument and objective method of utilizing consensus judgments, thereby discovering the most significant activities" (4, *p. 14*).

The same investigators (5) in a study of recreation leadership training emphasized the significance of the three criteria for rating activities—importance, frequency, and difficulty—with the statements:

> "Such a procedure gives a basis for a curriculum builder which of the duties he will omit for lack of time or for other reasons. Obviously he will include an activity which is very important, very frequently used, and very difficult" (5, *p. 7*).

Hoffer (10) made an analysis of the duties of recreation and informal education leaders and supervisors. This was done in two major stages, the first of which consisted of collecting approximately 8,000 items through a review of the literature and by studying daily activity diaries kept over a period of four to ten days by 1,300 youth leaders and supervisors. The unduplicated activities were combined and recombined until a list of 309 activities remained classifiable under 20 divisions.

Stage two consisted of supplementing the list by means of other sources. The activity items obtained were classified in tentative divisions and the items again combined and recombined. The resulting master list contained 69 activity items which were classified in ten divisions; this list was finally adopted as the accepted list of activities. This study shows the possibility of condensing a multitudinous list of activities into a manageable list for use in rating.

Jackson (12, 13) made a study for the purpose of finding out the existing situation with respect to the activities engaged in by teachers of physical education in the high schools of Illinois. The investigator wanted to secure information concerning the curriculum in physical education, the training of teachers, and self-evaluation of the adequacy of the training. In this study three inquiry forms were used. The first was sent to all of the high school

principals in the State of Illinois explaining the purpose of the study. The other two were sent to all of the men and women physical education teachers in the state. In all, 1,000 inquiry forms were sent out to the high school physical education teachers in the state and 440 high schools (45%) returned inquiry forms which were considered usable for the study. With respect to the data received concerning the adequacy of training, many instructors indicated their training was adequate, but often qualified this by adding "for the present situation."

In a study which combines the time study and job analysis techniques, Ferguson (8) devised a formula to determine the service load of a staff nurse. Variations of the formula also make it usable for the purpose of distribution of staff, expansion and development of a program, and costs of service. This study involved the following of patients from admission to the end of one year, or until dismissed, with microfilming, study, and analysis of these data. The investigator used the Hollerith Machine system, or punch card method. As a job analysis study, the findings have significance for educational institutions concerned with the training of public health nurses.

Rash (19) conducted an investigation of the duties of five different types of health educators for the purpose of securing a foundation for building the health education curriculum. The first step in this study was to interview 75 health educators, in order to determine the duties performed by them. The five types of health educators included in the study were school health educators, college health educators, health co-ordinators, health educators representing official health agencies, and health educators representing non-official health agencies.

After the health educators were interviewed, a rating scale was prepared and they were asked to rate the duties for frequency of performance, importance, difficulty of the duties, time spent on each duty, and time recommended for each duty.

The results of this study indicated the duties performed by the various types of health educators along with the relationship of classes of duties of the types of health educators. The findings are significant in terms of training health educators for specific jobs in the field of health education.

A recent investigation by the writer (11) explored the duties of personnel in charge of public school physical education programs. The primary objective of this study was to provide information for teacher-training curriculum purposes. Two major phases were necessary in order to accomplish the purpose of the study. The first phase consisted of the development of a list of duties performed by the public school physical education director and the second phase consisted of securing professional support in rating the duties.

The list of duties was developed through documentary analysis, personal logs and diaries, introspection, and interview with persons in the field. After the duties were collected, they were classified and developed into a tentative rating scale.

The tentative rating scale was used in a try-out study with 31 persons participating. On the basis of the try-out study, the rating scale was revised and submitted in final form to 380 public school physical education directors throughout the United States. These directors had been recommended by the personnel of 47 state departments who were responsible for the administration of the public school physical education program in their state.

Of the 380 public school physical education directors recommended for participation in the study, 305 or slightly over 80 per cent rated the duties for frequency, difficulty, and importance. Two hundred and ninety or approximately 76 per cent of the rating scales were deemed usable for the study.

The 290 public school physical education directors were separated into six different classifications with regard to size of community and grade level of pupils coming under direction.

Total scores were computed in each classification of public school physical education director for the three criteria for rating—frequency, difficulty, and importance. The total scores were transmuted into deciles for the purpose of facilitating comparison of the three criteria.

In terms of time spent on the various phases of the job, mean percentages were computed with regard to the approximate percentage of time spent on the broad classifications of the duties. The results of this study have been useful in establishing course content in professional physical education courses of an administrative and supervisory nature at the undergraduate and graduate levels.

Conclusions

In conclusion, it may be stated that contributions of job analysis studies in health, physical education, and recreation indicate the importance of this method of research in these areas. Various techniques of this particular research method have been described in this report along with some advantages and disadvantages of many of these techniques. This implies that there should perhaps be no set pattern for studies of a job analysis nature. On the other hand, the techniques employed should be in congruity with the nature, scope, and purpose of the investigation.

REFERENCES

1. Bartlett, L. W., and A. W. Boyd. *The YMCA Executive Secretary, An Analysis of the Activities of the Secretary Who Is Responsible for the Administration of a Local YMCA*, University of Chicago Press, Chicago, Illinois, Oct. 1929.
2. ———. *The YMCA Physical Director, An Analysis of the Activities of the Secretary Who Is Responsible for Physical Education in the Local YMCA*, University of Chicago Press, Chicago, Illinois, 1929.
3. Charters, W. W. *The Use of Activity Analysis in Curriculum Construction, Proceedings of the 64th Convocation of the University of the State of New York.*
4. ———, and V. Frye. *Recreation Workers Curriculum Study, Unpublished Report*, Ohio State University and Works Progress Administration in Ohio, Columbus, Ohio, August 1937.
5. ———. The Ohio Study of Recreation Leadership Training, Bureau of Educational Research Monographs, No. 2, Ohio State University, Columbus, 1942.

6. ———, AND D. A. HINDMAN, The Duties of Ohio Public Health Commissioners, *Bureau of Educational Research Monographs*, No. 17, Ohio State University, Columbus, 1933.
7. ———, AND D. WAPLES, *The Commonwealth Teacher-Training Study*, University of Chicago Press, Chicago, Illinois, 1929.
8. FERGUSON, M. *The Service Load of a Staff Nurse in One Official Public Health Agency*, Contributions to Education, No. 915, Teachers College, Columbia University, New York, 1945.
9. HINDMAN, D. A. An Analysis of the Activities of Physical Education Teachers in High Schools, *Research Quarterly*, **8**: 117 (May 1937).
10. HOFFER, J. R. An Activity Analysis of the Duties of Recreation and Informal Education Leaders and Supervisors, *Research Quarterly*, **15**: 50 (March 1944).
11. HUMPHREY, JAMES H. A Job Analysis of Selected Public School Physical Education Directors, *Research Quarterly*, **24**: 56 (March 1953).
12. JACKSON, C. O. Activities Engaged in by Teachers of Physical Education in the High Schools of Illinois, Part I, *Research Quarterly*, **13**: 242 (May 1942).
13. ———. Activities Engaged in by Teachers of Physical Education in the High Schools of Illinois, Part II, *Research Quarterly*, **14**: 60 (March 1943).
14. KOOS, L. V. Some Aspects of the Job Analysis of High School Teaching, *Journal of Educational Research*, **X**: 3 (Oct. 1924).
15. ———, AND C. WOODY. The Training of Teachers in the Accredited High Schools of the State of Washington, *Eighteenth Yearbook of the National Society for the Study of Education*, Public School Publishing Co., Bloomington, Ill., 1919.
16. MCCURDY, J. H. *A Bibliography of Physical Training*, Springfield, Massachusetts, Physical Directors Society of Young Men's Christian Association, 1905.
17. MONROE, W. S. The Duties of Men Engaged as Physical Directors or Athletic Coaches in High Schools, *Bureau of Educational Research*, Bulletin No. 30, University of Illinois, Urbana, 1926.
18. NEILSON, N. P. Job Analysis Should Be Applied to Physical Education, *The Journal of Health and Physical Education*, **1**: 9 (Jan. 1930).
19. RASH, J. K. Duties of Professional Health Educators, *The Journal of School Health*, **XX**: 10 (Dec. 1950).
20. Research Council of the Research Section of the American Association for Health, Physical Education, and Recreation. *Research Methods Applied to Health, Physical Education and Recreation*, Washington, D. C.: The Association, 1949.
21. SHEPARD, J. B. Duties Commonly Performed by Boys' Physical Education Department Heads, *Journal of Health and Physical Education*, **5**: 30 (April 1934).

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Concepts of Healthful Living of Functional Value in the General Education of Elementary School Pupils

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ONE OF THE MOST striking characteristics of education in 20th-century America is the ascending importance accorded the health of the school child. The increased quantity and quality of school health programs throughout the nation reflect well the tenor of modern education, and perhaps mark the beginning of an era in the schools. Nowhere has this awakened interest and attention found a setting more conducive to implementation than in the elementary school.

No other unit in our contemporary society possesses the limitless opportunities, or faces the multiplicity of stimulating challenges, that are lineaments of elementary education today. Under one figurative roof the lives of millions of children are guided and influenced during a period when knowledges, skills, attitudes, and practices are readily developed, often to endure for a lifetime. It is in such a setting that health education assumes the proportions of a societal force of considerable magnitude; a force not incapable of measurably raising the health of a nation.

Today the curriculum in health education should be designed to meet the needs and interests of the child. That this basic aim of health instruction in the elementary school is often unrealized, is surely a matter for concern and analysis. Fundamental to the development of a functional program of health education is a clear recognition of the significance of curricular validity.

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[1]This is the third and final report of a series of research studies in health instruction at the elementary school, high school, and college levels. The previous studies reported are:

Irwin, Leslie W. and Wesley M. Staton. A Determination of Fundamental Concepts of Healthful Living and Their Relative Importance for General Education at the Secondary School Level. *Research Quarterly* **22**: 3 (March 1951).

Irwin, Leslie W. and Clifford A. Boyd. A Determination of Concepts of Healthful Living and Their Relative Importance for a General Course in College Health. *Research Quarterly* **23**: 177 (May 1952).

The central purpose of the curriculum maker in health education is that of determining those knowledges and skills that are of utilitarian value in the present and future lives of elementary school pupils. Further, the problem of curriculum development necessitates careful consideration of the relative worth of course content in terms of its contribution to general education. It is with these issues that the present investigation is concerned.

The Problem

It is the purpose of this study to determine objectively those concepts of healthful living which are of functional value in contributing to the general education of elementary school pupils.

In view of the vast scope of knowledge and information which has some relationship to the present and future health of children of elementary school age, it has become increasingly difficult for teachers and administrators to select curriculum content in this area of education. Personal preferences, ease of teaching, and outmoded topical patterns have often influenced the kind and amount of health education material presented. Chenoweth and Selkirk (5, *p. 369*) draw sharp attention to the problem in these remarks:

> "A new examination of the facts now taught needs to be made in order to see what is omitted that should be taught, to relegate to their proper places those things that are of only minor importance, and to eliminate the things that are not true. Texts in health sometimes contain errors that are copied and quoted over and over again in books by other authors. Texts should be more critically examined by experts before they are adopted. Some of the things now taught do not have a value in keeping with the prominent place they occupy in teaching. One is inclined to suspect that some things are stressed because of the ease of teaching them and the difficulty of teaching other facts of greater importance."

As the first of a triad of prerequisites for the most effective teaching at both the elementary and the secondary school levels, Billett (1, *p. 150*) stresses the need for "the identification of the concepts and skills which are essential to, or consistent with, successful, happy, and socially desirable behavior in a democracy." Further authoritative recognition of the value of objectively determined principles or basic concepts to the efficacy of the instructional program in the schools is apparent in the recent recommendations of the National Society for the Study of Education (21). This report cites the investigations of Martin (18) and Wise (31) and draws attention to the importance of the principles of science, as determined by these workers, in improving the teaching of science in the nation's schools.

The classic Report of the Harvard Committee (25, *p. 63*) brings into sharp focus the pre-eminence of the problem of determining principles in the several areas of knowledge by stating:

> "Selection is the essence of teaching. Even the most compendious survey is only the rudest culling from reality. Since the problem of choice can under no circumstances be avoided, the problem becomes what, rather than how much, to teach; or better, what principles and methods to illustrate by the use of information."

These and other evidences from the professional literature tend to affirm the high significance of the problem of determining what shall be taught in the schools. The problem is particularly acute in the area of health education, inasmuch as this phase of the curriculum has not had the advantage of the extensive research concerned with the longer-established subject matter areas. It is not unusual therefore, to find that course content in health education has evolved largely on an empirical basis rather than in relation to the needs of society. From even a cursory observation of curricula, it would seem that the area of elementary school health education is a fertile one for analytical study. The quality of living, present and future, of millions of young Americans depends in good measure upon the validity of the learning experiences in personal and community hygiene provided by the elementary school.

Definitions of Terms Used

Concepts. Teachers' goals in the form of generalizations or principles; recognizable advances in educative growth to be made by pupils through experiences provided in the teaching unit (1, *p. 273*).

Deduction. The technique of reasoning or problem solving that affords conclusions concerning specific instances through the logical consideration of generalities (10, *p. 121*).

Disease. An unhealthy condition of a part or all of the body resulting from alteration of structure or function of cells, tissues, or organs; reaction to injury (8, *p. 42*).

Elementary School. A school for children of elementary school age that normally requires six years to complete the work provided (10, *p. 149*).

Health. A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (7, *p. 9*).

Healthful Living. A quality of life characterized by the attainment of the highest possible level of health commensurate with one's innate biological capacity for health.

Induction. A method of reasoning about generalities through the examination of particulars (10, *p. 215*).

Review of the Literature

Reports of investigations concerned with the issue of selecting and appraising subject matter, or problem areas, in health education are scanty. Early studies dealing in some degree with the curriculum in health education include those of Lerrigo (17), Strang (29), Cairns (3), Turner (30), Oberteuffer (22), Caldwell and Lundeen (4), Rhoton (26), Rooks (27), Salt (28), and O'Neill and McCormick (23). Later researches of the Denver Public Schools (6), Jessop (14), and Lantagne (15, 16) were concerned with pupil interests as a basis for teaching emphasis in school health education. Hoyman (11) and Byrd (2) have provided significant data relating to the identification of major health problem areas as curricular guides.

Irwin and Staton (13) reported an investigation aimed specifically at the determination of fundamental concepts of healthful living and the relative importance of such concepts for general education at the secondary school level. That study marked the beginning of a series of researches following the general design of those of Wise (31) and Martin (18) which have substantially benefited science education. Irwin and Boyd (12) reported more recently on a determination of concepts of healthful living and their relative importance in health education at the college level.

Analysis

For purposes of analysis and establishing a framework of reference for research procedure, the study was divided into two major parts, the inductive phase and the deductive phase.

INDUCTIVE PHASE

The purpose of the inductive phase was to determine a list of fundamental concepts of healthful living that would be of functional value in contributing to the general education of elementary school pupils. This phase of the investigation had four subproblems.

Subproblem A—To select and to determine the important concepts of healthful living occurring in 36 textbooks designed for use in the elementary school.

Subproblem B—To select and to determine the important concepts of healthful living occurring in 14 selected safety textbooks prepared for use in the elementary school.

Subproblem C—To select and to determine the important concepts of healthful living, appropriate for the elementary school level, occurring in 36 issues of *Hygeia* (*Today's Health*), a monthly publication of the American Medical Association.

Subproblem D—To select and to determine important concepts of healthful living through an analysis of vital statistics.

DEDUCTIVE PHASE

The purpose of the deductive phase of the study was to determine the scientific validity and relative importance for elementary education of those concepts derived from the inductive phase. The deductive phase included two subproblems.

Subproblem A—To determine from the ratings and judgments of representative medical and health authorities, the scientific accuracy of the concepts secured through the inductive phase.

Subproblem B—To determine from the ratings and judgments of representative health and elementary school specialists, the relative suitability and importance of listed concepts for health instruction at the elementary level.

Procedure

INDUCTIVE PHASE

Subproblem A. The content of 36 current and authoritative health texts designed for use at the elementary school level was read and analyzed for statements of basic concepts of health education. The textbooks were selected on the basis of the following criteria: 1. Up-to-date; 2. Authoritative; 3. Part of a series.

In order to satisfy the first criterion, the textbook must have been written or revised since 1940. In order to satisfy the second, the text must have been written by a well-known author, must not have been a first publication, and must have been published by a reliable publishing company. In meeting the third criterion, the book must have been especially designed as a part of an elementary school series of texts for grades one through six.

The criteria established for the identification of health concepts are basically the same as those used by various investigators in determining principles in science education (18, 31), and similar to those developed by Irwin and Staton (13) in the first research in fundamental concepts of healthful living.

The following criteria were used in the selection of concepts of health education:

1. Must be a comprehensive generalization or a part of a comprehensive generalization.
2. Must not be a definition.
3. Must be true without exceptions within the limitations specifically stated.
4. Must be stated definitely and/or may be implied in the writings of the author.
5. Must not deal with specific substances.

The following textbooks satisfactorily met the criteria established for elementary school texts and, therefore, were used as one fundamental source for the identification and determination of health concepts:

Safe and Healthy Living Series: Andress, J. M., I. H. Goldberger, Marguerite Dolch, and Grace Hallock. Boston: Ginn and Co., 1945. Titles: *Spic and Span; The Health Parade; Growing Big and Strong; Safety Every Day; Doing Your Best for Health; Building Good Health.*

Health of Our Nation Series: Brownell, C. L., and J. F. Williams. New York: American Book Co., 1942. Titles: *Well and Happy, Clean and Strong; Fit and Ready; Safe and Sound; Hale and Hearty; Active and Alert.*

New Health and Growth Series: Charters, W. W., D. F. Smiley, and Ruth Strang. New York: The Macmillan Co., 1941. Titles: *All Through the Day; Through the Year; Health Secrets; Healthful Ways; Let's Be Healthy; Habits Healthful and Safe.*

Irwin, Leslie W., W. W. Tuttle, and Caroline Dekelver. Chicago: Lyons and Carnahan, 1947. Titles: *Awake and Away; Growing Day by Day; Keeping Fit for Fun.*

Health-Happiness-Success Series: Burkard, W. E., R. L. Chambers, and F. W. Maroney. Chicago: Lyons and Carnahan, 1946. Titles: *Building for Good Health; Good Health Is Fun; Your Health and Happiness.*

Health, Safety, Growth Series: Turner, C. E., and colleagues. Boston: D. C. Heath and Co., 1941. Titles: *Growing Up; Keeping Safe and Well; Gaining Health; Cleanliness and Health Protection; Working for Community Health; Building Healthy Bodies.*

American Health Series: Wilson, C. C., C. B. Baker, P. J. Abbott, and J. C. Almack. New York: The Bobbs-Merrill Co., 1943. Titles: *Our Good Health; Healthy and Happy; Everyday Health; Health at Home and School, Health at Work and Play; Growing Healthfully.*

A careful page-by-page analysis of each of the 36 selected textbooks was made in order to identify those statements which met the criteria established

for health concepts. Each statement which satisfied the criteria was written on a file card along with the source reference. An analysis of each text was also made for teaching guides and for possible data relative to the gradation and progression of material.

Subproblem B. The content of 14 current and authoritative safety textbooks designed for use at the elementary level were read and analyzed for statements of basic concepts of healthful living. The same criteria previously established were used for the safety texts. The following textbooks, having satisfactorily met these criteria, were used as a second source for the identification and determination of health concepts.

The Road to Safety Series: Buckley, H. M., Margaret L. White, Alice B. Adams, and L. R. Silvernale. New York: American Book Co., 1942. Titles: *Away We Go (Book A); Happy Times (Book B); In Storm and Sunshine (Book C); In Town and Country; Here and There; Around the Year; Who Travels There.*

The Safety Sam Series: Bartrug, C. M. St. Louis: Webster Publishing Co., 1943. Titles: *Meet Safety Sam; Safety Sam's Friends; Growing Up With Safety Sam; Tips From Safety Sam; Growing Wise With Safety Sam; Playing Safe With Safety Sam.*

As with the health texts, a careful page-by-page analysis of the 14 safety textbooks was made to determine those statements which satisfied the established criteria for concepts. The selected concepts were written on individual file cards with notations as to the sources. Each textbook was also analyzed for teaching guides and for possible information concerning the gradation of material.

Subproblem C. The content of 36 issues of *Hygeia* (*Today's Health*), including the years 1946, 1947, and 1948, was read and analyzed for health concepts applicable to the elementary school level. The same concept criteria were applied and the same tabulation technique followed. The purpose of this analysis was to determine those health concepts which were based on medical and related research more recent than that reflected by some textbook statements.

Subproblem D. The fourth source of information for the identification and determination of basic concepts of healthful living was provided by analysis of vital statistics. This source was investigated last in order to obviate the possibility of bias in the selection of concepts from the literature cited.

Vital data were secured from the National Office of Vital Statistics, United States Public Health Service, Federal Security Agency, Washington, D. C. An analysis of these data was made for the years 1945, 1946, and 1947. The age group 5-14 years was considered to be representative of the elementary school population.

It is noteworthy that during the years 1945, 1946, and 1947 the five leading causes of death among children from five to 14 remained the same. Accidents (other than motor-vehicle), motor vehicle accidents, pneumonia and influenza, diseases of the heart, and tuberculosis (all forms) ranked in that order as prominent killers of elementary school children during the three years considered.

It should be noted here that since these data were reviewed and analyzed, there have been some changes in the list of leading causes of death in childhood. Recent statistical evidence (19) points to accidents (all forms), cancer (including leukemia and Hodgkin's disease), rheumatic fever and organic heart disease, pneumonia and influenza, and poliomyelitis respectively as the major killers among children of elementary school age during the year 1950. Such changes, however, would not significantly affect the validity of the vital data for 1945, 1946, and 1947 as a source for this study since a broad range of causes of mortality was analyzed. Thus, cancer, rheumatic fever, poliomyelitis, and other conditions which have become more prominent since the 1945-1947 period were included in the original review though they were ranked differently at that time.

Inasmuch as accidents ranked consistently highest in the list of killers of children, a more specific analysis of this factor was made. The nature and extent of pupil accidents, as reported by the National Safety Council (20), were analyzed for the school years 1940-41 through 1947-48. The data for this eight-year period reflect a steady increase in accidents occurring in school buildings from grades one through six. This accelerated incidence may be explained by the increased use of vocational shops, gymnasiums, and laboratories at the upper grade levels.

It is also significant that the incidence of home accidents begins to decline at the fourth grade. This would seem to emphasize the need for safety education stressing home safety throughout the primary grades. The same trends are apparent in the incidence of accidents in going to and from school, thus pointing up another area of emphasis for health and safety education in the primary grades.

On the other hand, accidents occurring in school buildings, on school grounds, and in locales other than the home or en route to school or home, tend to increase steadily from grade one through grade six. Accordingly, it becomes abundantly clear that appropriate units in safety instruction might properly be included as substantial phases of health education in the elementary schools.

Following the analyses of mortality and accident data, a comprehensive checklist was formulated. This list included statements derived from the cited sources and could be considered to represent those shortcomings of society which had implication for the curriculum in elementary school health education. The 305 concepts of healthful living derived from the analysis in Subproblems A, B, and C of the inductive phase were checked against the itemized statements resulting from the mortality and accident analyses. Additions, deletions, and corrections were made where indicated.

DEDUCTIVE PHASE

Subproblem A. The organized list of health concepts, derived from the inductive methods, was then submitted to a selected committee of health and medical authorities for the purpose of determining the scientific accuracy

of each concept. In order to be adjudged scientifically accurate, the concepts must have been consistent with current and generally accepted medical knowledge and research. The committee[2] consisted of five authorities representing the fields of public health, pediatrics, pathology, health education, and school medical practice. Personnel of this committee was selected on the basis of criteria appropriate to each area of specialization. That is, each specialist must have satisfied certain criteria, or objective prerequisites, which established his authoritative position in the field, in order to be appointed to the committee.

Subproblem B. The scientific validity of the health concepts having been established, the list was then submitted to two independent juries of experts in order that each concept might be rated in terms of its suitability for health education at the elementary school level. As with the committee of health and medical authorities, appropriate criteria were utilized in the selection of jurors. Each jury consisted of five members with the personnel assigned as follows:

Jury I

1. *Health Subject Matter Specialist*—Dr. Laurence B. Chenoweth, director of Student's Health Service, University of Cincinnati.
2. *Specialist in Child Growth and Development*—Dr. G. Lawrence Rarick, professor of physical education, University of Wisconsin, School of Education.
3. *Safety Education Specialist*—C. M. Bartrug, superintendent of schools, Iowa Falls, Iowa.
4. *Health Supervisor*—Grace D. Keenan, supervisor of health education, Brockton School Department, Brockton, Massachusetts.
5. *Health Teacher*—Jean V. Latimer, teacher training coordinator of health education, Massachusetts Department of Public Health, Boston.

Jury II

1. *Health Subject Matter Specialist*—Dr. H. F. Kilander, specialist for health education, Federal Security Agency, Washington, D. C.
2. *Specialist in Child Growth and Development*—Dr. Abigail A. Eliot, director of the Nursery Training School of Boston, instructor in child psychology, Boston University, School of Education.
3. *Safety Education Specialist*—Dr. Frederick A. Meier, Department of Science and Health Education, State Teachers College, Bridgewater, Massachusetts.
4. *Health Supervisor*—Edward J. Wall, director of health and safety education, Boston Public Schools.
5. *Health Teacher*—Dr. Hazel B. Milcham, supervisor of teacher training, State Teachers College, North Adams, Massachusetts.

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[2]*Public Health Specialist*—Dr. David L. Belding, professor of bacteriology and experimental pathology, Boston University, School of Medicine.

Health Education Specialist—A professor of health education.

Pathologist—Dr. Robert P. MacGate, associate professor of pathology, University of Illinois, College of Medicine.

Pediatrician—Dr. A. D. Bloomenthal, pediatrician and obstetrician, Waltham Hospital, Waltham, Massachusetts.

School Physician—Dr. Charles Berger, school physician, Public Schools, Quincy, Massachusetts.

The specialists comprising these two juries were asked to rate each of the 305 derived concepts of healthful living in terms of its relative suitability for elementary school health education as delineated by a five-point scale. "Suitability" was determined primarily in reference to pupil needs and interests at the elementary school level. In order to assure rating validity, the jurors were instructed in the rating technique, and the basis for the five categories was outlined as follows:

1. *Not at all suited* (does not in any way contribute to meeting the health needs or interests of pupils)
2. *Poorly suited* (does not adequately meet the health needs or interests of pupils)
3. *Neither well nor poorly suited* (adequately suits the health interests but not the health needs of pupils)
4. *Well suited* (adequately suits the health needs but not the health interests of pupils)
5. *Ideally suited* (adequately suits both the health needs and the health interests of pupils)

The ratings of each concept by members of the two juries were recorded on index cards. The median score of the five ratings acccorded by each individual jury to each concept was considered to best represent group appraisement in regard to teaching suitability.

Median ratings of both juries for each individual concept were summed to form the basis for rank-order distribution of the concepts. Thus, in the ultimate ranking the extreme values of the concepts ranged from two to 10. The median was chosen as the proper measure of central tendency, since its reliability is generally superior to that of the mean or mode in dealing with leptokurtic distributions. Thus, the inordinate influence of extreme ratings was avoided in determining a typical score for each concept.

In combining the two median scores afforded by the ratings of the two juries, a median rating of seven or above was considered to affirm concept suitability for teaching at the elementary school level. The discrete number seven was arbitrarily established as the mark of delineation for teaching suitability, since the attainment of this score depended upon a concept being rated four, or well suited, by one of the juries.

Reliability of the jury ratings was determined by the calculation of correlation ratios. At the same time, a measure of the departure of the regression from linearity could be made by comparing the correlation ratios with the product-moment coefficient of correlation calculated from the same data. The correlation ratio technique was used in order to provide for the possibility of curvilinear relationship between the ratings of Jury I and those of Jury II.

According to Garrett (9, *p. 367*), "*Eta* is a more general coefficient than *r* as it is applicable when regression is linear as well as when it is non-linear." Peters and Van Voorhis (24, *p. 312*) state further that, "*Eta* gives a measure of the extent to which the Y scores for each given value are grouped compactly together and, consequently, indicate the degree to which some law is present in the relation between the X and the Y factors."

The first correlation ratio, ηyx, a measure of the non-linear relationship in terms of the standard deviation of the Y-arrays, was found to be .90. The

second correlation ratio, ηxy, a measure of the non-linear relationship in terms of the standard deviation of the X-arrays, was found to be .89. The standard error of ηyx was .01. The same SE was found for ηxy.

Finally, product-moment coefficient of correlation (r) was determined so that a comparison would be possible between the two η's and r. The product-moment coefficient of correlation (r) was calculated as $.89 \pm .01$.

It is readily apparent that the two η's for these data are very nearly identical and worthy of a high level of confidence as reflected by the small standard error obtaining for each. Both regressions are quite close to linearity; hence, the product moment r of $.89 \pm .01$ indicates a marked relationship, or unanimity of appraisement, between the ratings of Jury I and those of Jury II.

The Findings

Since it was the central concern of this study to determine those fundamental concepts of healthful living which are of functional importance in the general education of elementary school pupils, it is these concepts then which constitute the body of the results of this investigation. The 305 derived concepts are listed in rank order by logical topical areas in Table 1 of this report.

Summary

The purpose of this investigation was to determine fundamental concepts of healthful living which are of importance for general education at the elementary school level, and to appraise these concepts in light of their suitability for teaching at that level. The study was organized into two major parts—the inductive phase and the deductive phase.

The procedure for the inductive phase involved the selection and determination of concepts of healthful living through: (a) an analysis of 36 health textbooks prepared for use in the elementary school, (b) an analysis of 14 safety textbooks designed for elementary school use, (c) an analysis of 36 issues of *Hygeia*, and (d) an analysis of vital statistics.

The procedure for the deductive phase included: (a) validation of the scientific accuracy of the concepts on the basis of judgments of health and medical authorities, and (b) an appraisement of the suitability of each concept for teaching in the elementary school by two juries of experts.

In the conduct of the study, certain observations were made which, though less objective than the core purpose procedures, would seem to represent findings of some significance. These observations, based upon the analysis of each of the 36 health texts, might be summarized as follows:

1. There is rather general agreement among authors concerning the precise nature, method of treatment, and gradation of health content.

2. There appears to be a certain amount of needless repetition of material at each grade level in most of the health series.

3. There is no treatment of sex education in any form in any of the textbooks.

4. Safety education appears to be dealt with somewhat inadequately in the majority of health readers.

Conclusions

Within the inherent limitations of the sources of material and the methods utilized, the following conclusions would seem justifiable and susbtantiative on the basis of the findings:

1. The derived list of 305 fundamental concepts of healthful living represents a core of scientifically valid generalizations which may properly be considered within the purview of elementary school health education.

2. Those concepts which have received a rating of *seven* or higher, based upon the summed median scores of the two juries, are "well suited" or "ideally suited" for health education in the elementary school.

3. Those concepts which have received a rating of from *three* to *six* are "poorly suited" or of average suitability for teaching at the elementary level.

4. Those concepts which have received a rating of *two* are considered "not suitable" for learning experiences in healthful living at the elementary school level.

Implications

The fundamental concepts of healthful living determined and evaluated through this investigation might well be considered as a framework of reference in curriculum development in elementary education. To this end, the concepts should be of some value to the following persons or groups:

(a) Elementary school administrators and classroom teachers.
(b) Health coordinators working with elementary schools.
(c) Elementary school health councils.
(d) College health educators concerned with the health aspects of teacher education for students majoring in elementary education.
(e) Authors of textbooks, workbooks, and other health education materials designed for use at the elementary school level.
(f) Producers, script writers, and others concerned with the preparation of films, radio programs, and telecasts to be used in connection with elementary school health education.
(g) Individual investigators and professional organizations concerned with research in the area of curriculum development.
(h) Authors of professional textbooks in elementary school health education designed for use in teacher education courses as well as in on-the-job situations.
(i) Elementary school curriculum committees.

Recommendations

During the investigation of this problem, certain issues of a related nature have become evident as being worthy of further research. These problems include:

1. An evaluation of the concepts determined by this investigation in terms of applicatory activities of daily living recorded on a valid and reliable population sample.

2. A determination of the relationships existing between these concepts, and their comprehension, and the possible prevention and/or reduction of deaths, disease, defects, and impairments reported by vital statistics, mor-

bidity surveys, accident data, and school health examinations for the age group 5-14 years.

3. An investigation of the extent to which these concepts of healthful living are a functional part of the several curriculum patterns followed by various elementary schools; i.e., "subjects taught in isolation," "the correlated curriculum," "the core curriculum," "the broad fields of living curriculum," and "the common-activities-of-living curriculum."

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REFERENCES

1. Billett, Roy O. *Fundamentals of Secondary-School Teaching.* Boston: Houghton-Mifflin Company, 1940.
2. Byrd, Oliver E. Health Problems of Significance for Course and Curriculum Construction. *Research Quarterly* **21:** 3 (March 1950).
3. Cairns, Laura. *A Scientific Basis for Health Instruction in Public Schools.* Berkeley, California: University of California Press, 1929.
4. Caldwell, O. W., and G. E. Lundeen. *Experimental Study of Superstitions and Other Unfounded Beliefs as Related to Certain Units of General Science.* New York: Bureau of Publications, Teachers College, Columbia University, 1932.
5. Chenoweth, Laurence B., and Theodore K. Selkirk. *School Health Problems.* New York: Appleton-Century-Crofts, Inc., 1947.
6. Department of Instruction Committee. *Health Interests of Children.* Denver, Colorado: Denver Public Schools, 1947.
7. *Final Acts of the International Health Conference.* Lake Success, New York: United Nations Publications, 1946.
8. Forbus, W. *Reaction to Injury.* Baltimore: Williams and Wilkins Co., 1943.
9. Garrett, Henry E. *Statistics in Psychology and Education.* New York: Longmans, Green and Co., 1947.
10. Good, Carter V. *Dictionary of Education.* New York: McGraw-Hill Book Co., Inc., 1945.
11. Hoyman, Howard S. *Health Guide for Oregon Teachers (Grades 7-12).* New York: Bureau of Publications, Teachers College, Columbia University, 1945.
12. Irwin, Leslie W., and Clifford A. Boyd. A Determination of Concepts of Healthful Living and Their Relative Importance for a General Course in College Health. *Research Quarterly,* **23:** 177 (May 1952).
13. ———, and Wesley M. Staton. A Determination of Fundamental Concepts of Healthful Living and Their Relative Importance for General Education at the Secondary-School Level. *Research Quarterly* **22:** 3 (March 1951).
14. Jessop, Mary Cooke. *Health Interests of High School Students.* Unpublished Master's thesis, Stanford University, 1948.
15. Lantagne, Joseph E. An Analysis of the Health Interest of 3,000 Secondary School Students. *Research Quarterly,* **21:** 34 (March 1950).
16. ———. Health Interests of 10,000 Secondary School Students. *Research Quarterly,* **23:** 330 (Oct. 1952).
17. Lerrigo, Marion W. *Health Problems Sources.* New York: Bureau of Publications, Teachers College, Columbia University, 1926.
18. Martin, William Edgar. *A Determination of the Principles of the Biological Sciences of Importance for General Education.* Unpublished Doctor's dissertation, University of Michigan, 1944.

19. Metropolitan Life Insurance Company. Changing Problems in Child Health. *Statistical Bulletin*, **32**: 3 (March 1951).
20. National Safety Council. *Accident Facts.* Published annually by the Council, 425 North Michigan Avenue, Chicago 11, Illinois.
21. National Society for the Study of Education. A Program for Teaching Science. *Forty-Sixth Yearbook, Part I.* Chicago: The University of Chicago Press, 1947.
22. Oberteuffer, Delbert. *Personal Hygiene for College Students.* New York: Bureau of Publications, Teachers College, Columbia University, 1930.
23. O'Neill, Florence C., and Mary G. McCormick. *Everyday Behavior of Elementary School Children.* Albany, New York: University of the State of New York, 1934.
24. Peters, Charles C., and Walter R. Van Voorhis. *Statistical Procedures and Their Mathematical Bases.* New York: McGraw-Hill Book Company, 1940.
25. Report of the Harvard Committee. *General Education in a Free Society.* Cambridge, Massachusetts: Harvard University Press, 1948.
26. Rhoton, Paul. *Health Misconceptions of Prospective Teachers.* Unpublished Doctor's dissertation, Pennsylvania State College, 1932.
27. Rooks, Roland. The College Freshmen's Knowledge of and Interest in Personal Hygiene. *Research Quarterly Supplement*, **6**: 73 (Oct. 1935).
28. Salt, E. Benton. *Health Misconceptions of Seventh, Tenth, and Twelfth Grade Students.* Unpublished Doctor's dissertation, New York University, 1936.
29. Strang, Ruth. *Subject-Matter in Health Education.* New York: Bureau of Publications, Teachers College, Columbia University, 1927.
30. Turner, C. E. Incentives and Interest in Health. *Journal of Education*, **60**: 274 (July 8, 1929).
31. Wise, Harold E. *A Determination of the Relative Importance of Principles of Physical Science for General Education.* Unpublished Doctor's dissertation, University of Michigan, 1941.

TABLE 1

Rank Order of Concepts by Logical Topical Areas

I. Healthy Living

1. Only a healthy child can realize the maximum value from school experiences. (10)
2. Avoidance of infection is the best protection against communicable disease. (10)
3. The health of every part of the body depends on the health of the whole body. (9)
4. All living things are made up of cells. (8)
5. Proper habits of living improve the general health of the body. (8)
6. A knowledge of the body, its functions and its care gives us the groundwork for a program of healthy living. (7)
7. Poor color, flabby flesh, or skin eruptions may indicate an unhealthy condition and may be the symptoms of disease. (7)
8. The keynote of child health is prevention. (4)
9. A person is said to be in good health when his body and mind work harmoniously, so that the whole organism is capable of adapting itself to the demands made upon it by society. (2)

II. Growth and Development

10. Children like to grow. (10)
11. Children are expected to grow within the range of a normal pattern. (10)
12. Regular gain in weight is a sign of health. (10)
13. For human beings, growing up means developing abilities as well as increasing in size. (10)
14. Sunshine is good for all growing boys and girls. (10)
15. Sickness sometimes slows growth. (10)
16. Bones become larger and stronger as the body grows. (10)
17. Rest helps children to grow. (9)
18. Growth is marked by fluctuations in pace. (8)
19. Growth is rapid at some ages and slow at others. (8)
20. Each child is an individual with his own growth and health patterns. (8)
21. There are many differences in height and weight of children of the same age. (6)
22. Growing up is a process of interaction between the child and the environment. (2)

III. Safety and First Aid

23. Safety rules and signs are needed to protect children from accidents. (10)
24. Children who are careful are seldom hurt. (10)
25. Careful boys and girls find safe places in which to play. (10)
26. The fire drill teaches children how to leave the school building safely in case of fire. (10)
27. The fireman teaches children to stay away from fires and matches. (10)
28. It is probably best to stay out of water for at least an hour after eating. (10)
29. Boys and girls must play carefully on the playground. (10)
30. Fires must have air or they will not burn. (10)
31. Children should always follow the safest way to and from school. (10)
32. One way to avoid accidents in the home is to keep things where they belong. (10)
33. A good swimmer always finds out whether there are any rocks or deep holes or other dangerous places to look out for in a new swimming place. (10)
34. Policemen help children on the way to school. (10)
35. Children must play safe when skating and sliding. (10)
36. Hard bumps on the head are sometimes dangerous. (10)
37. Children should stay away from strange animals. (10)
38. Children should learn to recognize poisonous plants and to avoid them. (10)
39. Cuts and scratches may be dangerous and should be cared for right away. (9)
40. Most falls come from carelessness. (8)
41. It is not safe for children to play with sharp tools or machinery. (8)
42. Nothing in a first aid kit should be poisonous except tincture of iodine. (8)
43. Poisons should be kept where children cannot get hold of them. (8)
44. Resting when you are tired is a safety precaution because it saves the body from strain and over-fatigue. (7)
45. Bad accidents in camping are usually caused by guns, falls, fire, and water. (7)
46. A dog bite may carry rabies to children. (7)
47. A safety council helps children to prevent accidents. (6)
48. Most lives are lost in fires because no preparation has been made for the emergency and the people involved do not know how to act. (6)
49. Severe bleeding must be checked quickly or death may result. (5)
50. A good driver obeys the traffic rules and regulations. (5)
51. Everyone should know what to do when someone is hurt. (4)
52. Sunstroke can be avoided by keeping the head covered and by avoiding long exposures to direct sunlight during hot weather. (4)
53. It is dangerous to rub a frozen part or to warm it too quickly. (4)
54. The prevention of unnecessary deaths from accidents demands a continuous campaign of education against carelessness and thoughtlessness. (2)
55. In case of suffocation time is a vital factor and immediate action is necessary. (2)
56. The diabetic child should always be taught to take care of himself. (2)

IV. Bacteria, Viruses, and Immunity

57. All boys and girls should at least be vaccinated against smallpox, diphtheria, tetanus, and whooping cough. (10)
58. Flies and mosquitoes may carry disease. (9)
59. Most disease-producing bacteria grow best in dark, warm, damp places. (9)
60. There is no vaccine that guarantees immunity to colds. (8)
61. The eyes, ears, nose, mouth, and skin are avenues through which germs may enter the body and cause disease. (7)
62. Pollen allergy can be detected by skin tests. (6)
63. Promiscuous spitting spreads disease and should be avoided. (4)
64. Antitoxin cures diphtheria and tetanus if taken in time. (4)
65. Colds are caused by germs called viruses. (3)
66. Certain of the sulfa drugs and antibiotics are effective in treating some types of pneumonia. (3)
67. Hay fever and other similar diseases are due to allergies. (2)
68. Germs may pass through a broken eardrum and cause trouble inside the ear. (2)
69. Ultraviolet light is helpful because of its ability to kill many pathogenic bacteria. (2)
70. When a person has had diphtheria or has received an injection of toxoid, he makes his own antitoxin and is immune to diphtheria. (2)
71. Quinine and other drugs cure the symptoms of malaria. (2)
72. The bacteria that cause tuberculosis are rod-shaped and are called tubercle bacilli. (2)
73. A high white blood count indicates that the body is trying hard to defend itself against invading bacteria. (2)
74. In the treatment of pneumonia serums have been used with good results. (2)
75. Poisonous substances called toxins are formed by the growth of certain germs both inside and outside the body. (2)

76. There are three major forms of bacteria. (2)
77. The tuberculin test is a diagnostic test to determine whether a person has or has had tuberculosis. (2)
78. A vaccine prevents disease and an immune serum helps to cure or lessen the severity of disease. (2)

V. Cleanliness

79. The school fountain must be clean and properly constructed for children. (10)
80. Animals that are not clean do not belong in the house. (10)
81. Clean hands and bodies help in guarding against disease. (10)
82. Baths with warm water and soap are necessary if the skin is to be kept in good condition. (10)
83. In order to be healthy, children must wash their hands and faces before eating and wash their hands after going to the toilet. (9)
84. A warm bath before bedtime helps children sleep. (8)
85. Children should breathe only clean fresh air. (8)
86. The skin regulates body heat, protects tender parts beneath, and gives us our sense of touch. (8)
87. Dirty feet are good growing places for the mold that causes athlete's foot. (6)
88. Feeling clean may help children to sleep well. (5)
89. Wearing shoes is the biggest safeguard against hookworm. (2)
90. The color of the skin comes from the pigment in the deep layers of the epidermis. (2)

VI. Infectious and Parasitic Diseases

91. Colds are catching. (10)
92. Measles are catching. (10)
93. Children who cover their noses and mouths when they sneeze or cough protect others. (10)
94. Head lice are carried from one person's head to another's by hats, combs, and brushes. (10)
95. A sore throat may be the first sign of a cold or of some children's disease. (10)
96. A cold that is neglected may spread and cause serious infection. (10)
97. Impetigo and scabies are communicable. (10)
98. In order to prevent the spread of colds children should cover their noses and mouths with handkerchiefs when they sneeze. (10)
99. There are three serious diseases that one need not have today because of vaccination: smallpox, diphtheria, and typhoid fever. (9)
100. Whooping cough is a dangerous disease caused by bacteria. (8)
101. Pinkeye is a catching disease caused by germs. (8)
102. A dog bite may carry rabies to children. (8)
103. Whooping cough is very catching from the first day when a person seems to have a slight cold until he stops coughing after four weeks. (8)
104. Chickenpox lesions occur as tiny water blisters that rupture easily and may cause pitting of the skin. (8)
105. Dust clogs the nose, irritates the throat and may predispose to colds. (7)
106. Children with rheumatic heart disease commonly exhibit a murmur, which is a hissing or blowing sound heard with the stethoscope. (6)
107. Common ailments such as headache, sore throat, running eyes, nausea, and fever may be early symptoms of a communicable disease. (6)
108. A carrier of disease harbors germs in his body without being sick himself. (6)
109. The hookworm is a tiny worm that gets into the body usually by way of the skin of the foot and causes disease. (5)
110. Tetanus may follow any wound, even one which seems trivial, but particularly those that are deep and contaminated with dirt. (5)
111. Diphtheria is one of the most dangerous diseases for small children. (4)
112. X-ray is used to tell if tuberculosis has causd damage to the lungs. (4)
113. Children of tuberculous parents may contract tuberculosis because of exposure. (4)
114. Scarlet fever is a dangerous disease because it may cause deafness, weak heart, or other defects. (4)
115. Since the openings from the sinus into the nose are not large, they may become blocked up and cause a painful and serious infection. (4)
116. The diet of the child is important in the prevention of tuberculosis. (3)
117. The child handicapped with cerebral palsy expends more energy than the normal youngster, and in consequence tires more easily. (3)
118. Hookworm disease causes a tired, lazy feeling and in severe cases may seriously interfere with growth. (3)
119. The greatest danger to the ear is an infection in the middle ear. (2)
120. When a person has a cold or sore throat the infection may spread to the ears by way of the eustachian tube. (2)

121. Most children with tuberculosis show no symptoms of illness. (2)
122. When infantile paralysis is present in a community any child with the slightest symptoms of a cold or fever should be given the most careful study by a physician. (2)
123. Measles and German measles are two different diseases and one provides no protection against an attack by the other. (2)
124. Exposure to cold is an inciting factor in many cases of pneumonia. (2)
125. Acute infectious diseases of the upper respiratory tract are the chief inciting causes of pneumonia in children. (2)
126. Influenza and other diseases may result in chronic middle ear disease. (2)
127. Cardiac involvement is one of the most common manifestations of acute rheumatic fever. (2)
128. The commonest heart disorder of childhood is rheumatic heart disease. (2)
129. The school program should be modified to suit the needs of a child with heart disease. (2)
130. Malaria is caused by tiny animal parasites and is carried from person to person by certain mosquitoes. (2)
131. Vaccines can prevent whooping cough in small children. (2)
132. Rocky Mountain spotted fever could be eradicated were it possible to dispose of insect carriers of the disease. (2)
133. Sanatorium treatment for tuberculosis consists largely of rest, fresh air, good food, and drugs. (2)

VII. Heart and Circulation

134. Red blood cells carry oxygen to all parts of the body and white cells are guards against disease. (9)
135. The heart beats faster in children than in adults. (8)
136. A healthy heart works much better if it has sufficient rest. (8)
137. Poor circulation of the blood to the hands and feet is sometimes caused by cold weather. (7)
138. Blood vessels consist of three basic types—arteries, veins, and capillaries. (6)
139. When a healthy person is at rest, the pulse rate is usually betwen 60 and 90 beats per minute. (5)
140. The brain more than any other part of the body needs a constant supply of blood. (5)
141. Rheumatic fever affects the heart muscle and valves and as a result the heart is weakened and often enlarged. (3)
142. Hemophilia is a disease of blood platelets which prolongs clotting time. (2)

VIII. Cancer

143. Cancer is not hereditary or contagious. (3)
144. There are three currently accepted treatments for cancer—surgery, X-ray, and radium. (2)

IX. Dental Health

145. Good teeth are important to health. (10)
146. The dentist helps children to care for their teeth. (9)
147. Good food helps teeth to grow strong, makes them hard and solid, and is of value in preserving them. (9)
148. Poisons from decayed teeth may be carried by the blood to other parts of the body. (7)
149. Six-year molars are important because they grind food during the time when the primary teeth are being replaced with permanent ones. (6)
150. Irregularly placed teeth should be corrected during childhood by a competent dental specialist called an "orthodontist." (5)
151. X-rays should be made periodically to detect small cavities in the teeth. (4)

X. Mental Health

152. Nerve endings in the skin give the sensations of touch, heat, cold and pain. (9)
153. Information concerning sex should be given in reply to a child's question. (8)
154. The nervous system makes it possible for muscles in many different parts of the body to work together for a common purpose. (6)
155. Even normal children occasionally show some aggressive behavior. (4)
156. The attitudes of parents play a major role in the development of a child's personality. (2)
157. Care of mentally deficient children is institutional, as average homes are physically, socially, and economically unable to cope with them. (2)

XI. Food and Nutrition

158. Milk is the best food for boys and girls. (10)
159. Tea and coffee are not good drinks for children. (10)
160. Water is essential to life. (10)
161. On a cold day it is best to eat a warm lunch. (10)

162. Proteins are the principal building materials of the body. (10)
163. Food should be protected from flies as they may spread disease from person to person. (10)
164. Boys and girls must eat good food and drink water every day in order to maintain health and growth. (9)
165. Food and milk will keep longer if they are kept cold. (9)
166. Various foods are necessary to prevent certain diseases. (9)
167. In planning meals for a day, it is necessary to make sure that you have enough of all the food materials which the body needs for energy, building and repair and health protection. (9)
168. The best milk comes from healthy cows. (9)
169. Fruit has a place in every meal. (9)
170. A good appetite is one sign of health. (9)
171. Healthy people like to eat. (9)
172. Sugar is a good energy food because it is digested quickly and supplies energy at once. (9)
173. It is not wise to include too much sugar in the ordinary diet because sugar satisfies the hunger and destroys the desire for other essential foods. (8)
174. Good meals include some rough food which helps eliminate waste from the digestive tube within the body. (8)
175. Cod-liver-oil helps to keep boys and girls healthy and to prevent colds and rickets. (8)
176. It is usually not good to eat too much between meals. (8)
177. Only pure water is good to drink. (8)
178. Unless proper care is taken foods will spoil and become unfit to eat. (8)
179. Disease germs grow readily in milk and may cause sore throat, scarlet fever, diphtheria, or typhoid fever. (8)
180. Iron helps to give blood its red color. (8)
181. Malnutrition often causes a person to tire easily and weakens body resistance to disease. (8)
182. Raw fruits and vegetables must be washed clean before eating. (7)
183. Inside the body foods are changed into simpler forms that can be used for fuel or for the growth and repair of cells. (7)
184. The sudden loss of appetite in a normal child usually indicates acute illness. (7)
185. Lack of sunlight may cause bones to become weak. (7)
186. Vitamins are substances found in certain foods that are needed for health and growth. (7)
187. A good breakfast will help children to keep warm on cold mornings. (6)
188. Calcium, phosphorus, and vitamin D are essential for building healthy bones and teeth. (6)
189. Vegetables and fruits lose vitamins in cooking. (6)
190. Fresh vegetables and fruits protect the body against scurvy. (5)
191. The liver is a storehouse for fuel that the body uses for the production of energy and heat. (5)
192. Calcium and iron are two important minerals that often are in short amounts in the diet. (5)
193. A healthy stomach is a disinfecting station of great value. (5)
194. Pork should always be thoroughly cooked to prevent the disease called trichinosis. (5)
195. Good eating habits are essential for healthy children. (5)
196. Foods highly seasoned may irritate the lining of the stomach. (4)
197. Pasteurized milk is safer to drink and will keep longer than raw milk. (4)
198. In regions where the soil has low iodine content, people may develop a condition called goiter. (4)
199. Gastric juice comes from the cells lining the stomach and starts the digestion of protein food. (4)
200. Pellagra, a disease that brings about sore mouths and flaming skin rashes, as well as digestive upsets and nervous disorders, is an example of a food deficiency disease. (2)

XII. Sleep and Rest

202. Children who are ill should rest in bed. (10)
203. After playing, children need rest. (10)
204. The younger you are the more rest you need. (10)
205. Sleep and rest are natural ways by which the body restores its strength and power. (10)
206. The amount of sleep needed depends partly on the person's age, the amount of exercise he takes, and his general health. (10)
207. A regular hour for going to bed and getting up encourages sound sleep. (10)
208. Sleep rests every part of the body and helps it to get ready for the next day's work and play. (10)
209. Good sleeping habits will help a person to get the most out of sleeping hours. (8)
210. Children who have colds should stay in bed. (8)
211. The body builds itself up while resting. (8)
212. A rested body is better able to defend itself against harmful germs than is a tired body. (8)
213. Children need appropriate rest at different intervals. (7)

214. Children must prepare for bedtime in order to go to sleep quickly. (7)
215. Sleep and rest, good meals at regular times, exercise and fresh air, are the best helps to healthy nerves and the brain. (6)
216. Overwork and over-fatigue, when accompanied by little rest and sleep, form a combination of factors that weaken the body's resistance to disease. (5)

XIII. Posture and Exercise

217. The right kind of exercise trains the muscles and makes them strong. (10)
218. Play and exercise every day help the body to get rid of wastes. (10)
279. Exercise makes muscles tired and rest or sleep will help refresh them. (10)
220. Play and exercise improve the appetite and digestion. (10)
221. Swimming is an exercise which brings into play every muscle of the body. (10)
222. Proper posture allows all the body organs to do their best work. (10)
223. Good posture is one sign of health. (9)
224. The tone of the whole body is improved by exercise. (9)
225. Good posture helps children keep well and strong. (8)
226. Posture is important in building a good framework for the body. (8)
227. A good sitting position helps blood to circulate. (18)
228. Exercise increases the rate of breathing and also makes the heart beat faster. (7)
229. Anything that helps make children strong and healthy, helps them have good posture. (6)
230. A straight framework is necessary if bodies are to attain their greatest strength. (6)
231. Proper rest after vigorous exercise is necessary in order to get rid of lactic acid. (6)
232. Good posture should be a habit. (5)
233. Chest expansion should increase with growth. (5)
234. Voluntary muscles never work unless they are called into action by the nerves. (4)

XIV. Recreation and Play

235. Recreation helps children to grow to be strong and to be healthy. (10)
236. In general, summer camp is a valuable experience for the average healthy child. (8)
237. Good physical education in school lays a foundation for happy, healthful adult recreation. (6)

XV. Elimination of Wastes

238. A child should go to the toilet to get rid of wastes whenever he feels the need. (9)
239. Cereal and bread made from whole grains help people to have a bowel movement regularly. (8)
240. Wastes in the large intestines are made up of bacteria, dead cells, secretions, and the parts of food that the body cannot digest. (8)
241. The large intestines can be trained to clear themselves of waste material without the aid of medicines. (8)
242. Perspiration keeps the body cool and carries off waste materials. (8)
243. The wastes produced by working cells are picked up by the blood and carried to the kidneys for removal. (7)

XVI. Clothing

244. Warm clothes prevent heat from leaving the body. (10)
245. Clothes must be worn according to the season of the year. (10)
246. Rubbers and raincoats should be removed when indoors, because by keeping out air they do not permit adequate evaporation of sweat from the skin. (10)
247. The clothing you wear helps to keep the body at the right temperature. (9)
248. Clothes should fit the weather as well as the person wearing them. (9)
249. Wet clothes make the skin cold and may help lower resistance to sickness. (8)
250. Children's clothing should be light, loose, and easy to clean. (6)

XVII. Light and Air

251. Good light is essential for good reading. (9)
252. When the thermometer says 70 degrees, the air temperature is just about right. (8)
253. All living things use air in some way. (8)
254. The skin protects the body from heat and cold. (8)
255. Steady quiet breathing shows that a person is taking air into the lungs that is needed to keep the blood stream supplied with oxygen. (8)
256. Air should usually enter the body through the nose rather than through the mouth because the nose is better equipped to prepare air for the lungs. (8)
257. Mold grows without sunshine and spoils food. (6)
258. As long as the body is well and healthy the body temperature remains almost constant. (6)
259. Carbon dioxide like oxygen is part of the air and is necessary for plants and animals. (4)
260. Heat will relax the blood vessels of the skin while cold will contract them. (4)

XVIII. Vision and Hearing

261. Earache is a sign of trouble and should get prompt attention. (10)
262. A person who is color blind cannot tell which things are colored green, and which are colored red. (8)
263. Good eyesight is essential in the development of a healthy child. (6)
264. The structure of the eye is like that of a camera. (5)
265. Air which is set into motion by vibrations produces sound waves. (5)
266. It is a poor practice to place objects in the ear. (5)
267. Injury to the eardrum causes pain and sometimes interferes with hearing. (4)
268. The hard of hearing child usually rates lower in leadership and is much less aggressive than a normal hearing child. (4)
269. Cross eyes may be corrected through proper medical care. (4)
270. The heredity of color-blindness has been worked out, and it may serve as a pattern for virtually all of the other sex-linked traits. (2)

XIX. Health Service

271. The doctor cares for children when they are ill. (10)
272. The school nurse gives children first aid and helps them with their health needs. (10)
273. Children should be vaccinated before they go to school. (10)
274. The first essential of healthy school living is to keep the classroom clean. (9)
275. A podiatrist treats simple diseases of the feet. (8)
276. The health examination is the first step in any sound health program. (8)
277. An oculist examines children's eyes and prescribes glasses. (7)
278. The American Red Cross teaches people how to give first aid. (7)
279. The sounds which come through the stethoscope tell the doctor wheher or not a person's heart and lungs are working properly. (7)
280. A doctor has many special ways of finding out whether the body is as healthy as it can be. (7)
281. Doctors believe that people can do some things to give their bodies the best chance to resist colds. (6)
282. Speech quality of the voice can be improved. (6)
283. A health examination every year helps a person to keep well and strong. (5)
284. The safest procedure to follow when there is pain in the abdomen for three or four hours is to stay in bed and call a doctor. (5)
285. Diseased and enlarged adenoids and tonsils should be removed. (4)
286. Mechanical aids to breathing are part of the equipment of all big hospitals today. (3)
287. The Schick test determines whether or not a person will get diphtheria if the diphtheria germ gets into the body. (3)
288. The Snellen Chart is useful in testing vision. (3)
289. The Federal Government carries on many surveys to aid the sick and injured. (3)
290. The necessity for Wood's Light examination in the schools, both for diagnosis and follow-up of ringworm of the scalp, is established beyond question. (3)
291. Removal of tonsils and adenoids is one way to prevent continued trouble with the middle ear and mastoid process. (2)
292. Hearing is tested in the schools by such tests as: the whisper test, watch test, or by the the audiometer. (2)
293. An important reason for having a thorough health examination every year is to discover foci of infection. (2)

XX. Community Health

294. Dirty garbage and manure help breed flies. (10)
295. Health officers quarantine people who are sick with certain diseases in order to prevent the spread of disease. (10)
296. A good place to live must be warm and dry. (9)
297. Good housing is necessary for good health. (8)
298. Towels and wash basins in public washrooms or other public places are sources of infection. (8)
299. The State Board of Health tests and approves food and water. (8)
300. The food inspector guards the public health by making sure that food sold in the stores is clean and fresh and carries no germs. (8)
301. Health Departments are interested in preventing and controlling communicable diseases. (8)
302. Drinking water which is not pure may cause disease. (7)
303. The use of filters and chlorine keeps the city water supply clear and pure. (6)
304. Proper disposal of wastes is important in preventing typhoid fever. (6)
305. Methods of avoiding dust in working conditions can reduce the number of cases of silicosis. (2)

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Comparison of Testers and Subjects in Administering Physical Fitness Index Tests

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THE TECHNIQUE OF administering the Physical Fitness Index (PFI) test in physical education is frequently quite inaccurate. Skill in the use of measuring instruments needed for this test requires much practice under trained supervision. Although the instruments themselves are properly calibrated, they cannot produce results better than the testing capabilities of the individuals using them.

The purpose of this study was to compare the scores obtained when PFI tests are given to non-oriented subjects by inexperienced testers with the results obtained when the subjects are oriented and the testers are experienced.

Procedure

The subjects utilized in this study were 41 physical education seniors enrolled in a Tests and Measurements course at Springfield College. The entire PFI battery was administered twice to these students under the following conditions:

First test: In the initial testing situation, the subjects had had no prior experience in taking PFI tests. The testers were seven inexperienced senior students in the course, who administered the tests for the first time.

Second test: The same subjects were again given the PFI battery, thus benefiting from the previous experience. This time, however, the testers consisted of the Tests and Measurements Laboratory staff (all of whom had administered the PFI on numerous occasions).

Other conditions under which the experiment was conducted were as follows: The two tests were given one week apart. As the testing was a class assignment, the student testers were to be graded, thus insuring a conscientious effort on their part. The PFI test techniques were as described by Clark (1).

Statistical Analysis

In analyzing the test results obtained in this study, two statistical procedures were utilized, as follows:

1. *Correlation*: Coefficients of correlation were computed by the product-moment method for the results obtained under the two testing situations for each of the test items in the battery and for the PFI itself. These results were then compared with similar correlations reported for these tests. Established objectivity coefficients for the tests are as follows (2):

Test	r
Lung capacity	.97
Right grip	.92
Left grip	.90
Back strength	.88
Leg strength	.86
Pull-ups	.91
Push-ups	.90
Strength index	.94

2. *Comparison of Means*: The differences between the means obtained for each of these tests and the PFI under the two testing situations were computed. These differences were tested against the null hypothesis based upon "Students" distribution (3) to determine their statistical significance. On this basis t ratios of 1.69 and 2.44 for 41 cases denoted significance at the .05 and .01 levels of confidence respectively. These t's were chosen because differences were measured in a positive direction only. The data were regarded as obtained from correlated groups.

Results

Table 1 contains the results of this experiment. A discussion follows.

TABLE 1

Correlations and Differences Between Means Obtained by Skilled and Unskilled Testers in Administering PFI Tests to College Men

Test item	r	Means		Difference between means	Standard error of difference	t
		Skilled testers	Unskilled testers			
Pull-ups	.99	9.5	8.8	.7	0.1	7.0
Push-ups	.89	14.5	11.2	2.8	.36	7.7
Leg lift	.48	1418.0	1196.0	222.0	34.9	6.4
Back lift	.74	542.0	464.0	78.0	9.98	7.8
Left grip	.62	121.0	106.0	15.0	2.33	6.4
Right grip	.70	135.0	121.0	14.	2.13	6.6
Lung capacity	.81	310.0	295.0	15.0	3.67	4.1
PFI	.71	107.0	90.0	17.0	1.68	10.1

Pull-ups: The correlation between the pull-up tests administered by the experienced and non-experienced testers was .99, indicating excellent agreement in the relative positions of the subjects on the two tests. This high coefficient exceeds those previously reported as noted above; it may be attributed to the fact that both the testers and subjects had become thoroughly familiar with this test in other aspects of their physical education program. The experienced testers, however, obtained higher scores than did the non-experienced testers; the mean scores were 9.5 and 8.8 pull-ups, respectively. The difference was .7; the t was 7.0. This difference was statistically significant well beyond the .01 level of confidence. Thus, it was demonstrated

that experienced testers obtain appreciably higher scores than non-experienced testers in administering this test.

Push-ups: The correlation of .89 shows considerable agreement between the skilled and unskilled examiners and compares well with the established correlation of .90. The average push-ups obtained by the skilled examiners was 14.0, while the mean obtained by the non-skilled examiners was 11.2. The obtained difference of 2.8 push-ups between the means resulted in a t of 7.7, which is signficant well beyond the .01 level of confidence. This rather large difference, accompanied by an r of .89 indicates that the inexperienced testers, although fairly consistent with the trained testers in their scoring, jeopardized the final PFI score. This poorer performance was due to allowing the subjects to go beyond a 90-degree angle in downward movement of dip.

Leg lift: Certainly the most difficult test to administer in the PFI battery is the leg lift; the correlation of .48 clearly illustrates the lack of agreement between the experienced and non-experienced testers. The mean obtained by the skilled testers was 1418 while the unskilled examiners obtained an average of 1196, a difference of 222 pounds. A t of 6.4 indicated the difference between these two means was significant beyond the .01 level of confidence.

A great deal of experience is demanded in the administration of this test as the data reveal. Inability to obtain proper results with the leg test is frequently the cause of low PFI scores obtained in using this battery in physical education.

Back Lift: Even though the back lift appears to be an easy test to administer, experienced testers and subjects obtain more valid results. The obtained r of .74 cannot be considered satisfactory when contrasted with correlation of .88 established for the test. The experienced testers obtained a mean of 542 pounds, while the inexperienced testers reported an average of 464, a difference of 78 pounds. The t of 7.8 is significant well beyond the .01 level of confidence.

Left grip and right grip: The objectivity coefficients of .62 for left grip and .70 for right grip respectively were surprisingly low. The mean obtained by the experienced testers for left grip was 121 pounds, while the inexperienced examiners recorded an average of 106 pounds. The difference of 15 pounds resulted in a t of 6.4, significant beyond .01 level of confidence.

The results of the right grip data somewhat parallel that obtained with the left grip. The mean reported by the skilled examiners was 135 pounds, while the average obtained by the non-skilled testers was 121, a difference of 14 pounds. This difference is significant well beyond the .01 level of confidence as the t of 6.6 indicates.

These data illustrate the necessity of proper technique in such a simple test as grip strength.

Lung capacity: Perhaps the easiest and most consistent test to administer in the PFI battery is lung capacity. The data collected by the skilled examiners showed poor agreement with those obtained by the non-skilled testers. The objectivity coefficient of .81 is far too low when repeating the same test

on the identical group. The average of 310 cc. obtained by the laboratory staff was 15 cc. greater than the mean of 295 cc. recorded by the student examiners. This resulted in a t of 4.1, significant beyond .01 level of confidence.

Physical Fitness Index: The correlation between the PFI administered by the experienced and non-experienced testers was .71, indicating poor agreement in the relative positions of the subjects on the two tests, as contrasted with the objectivity coefficient of .94 established for this test. The average reported by the unskilled examiners was 90, which is 10 points below the national norm; the experienced testers obtained an average PFI of 107. The difference of 17 points between the PFI's obtained by the inexperienced and experienced testers has higher statistical significance than has any of the single test items; the t was 10.1. The average PFI of 107 contrasts well with results reported for similar groups of physical education students.

Summary and Conclusions

The correlation of .99 between pull-ups and .89 between push-ups respectively were the highest correlation coefficients obtained. The remaining correlations ranged from .48 to .81, much too low when being thought of in terms of objectivity.

The high r between pull-ups is probably due to the fact that the subjects and the student testers had become thoroughly familiar with this test in other phases of the physical education program.

The correlation of .89 for push-ups was quite high, but the difference of 2.8 between means was significant well beyond the .01 level of confidence. This difference might be attributed to the fact that the inexperienced examiners jeopardized the subjects' scores by allowing them to go beyond a 90-degree angle in the downward movement of the dip.

The lowest correlation was .48, which indicated poor agreement between the laboratory staff and the inexperienced testers for leg lift. This result would be expected, owing to the difficulty involved in administering this test.

In every case, the computed t's indicated that differences existed between the obtained means, which were significant beyond the .01 level of confidence. These differences were always in favor of the experienced examiners, that is, the laboratory staff consistently obtained the higher scores for each test.

The results of this experiment clearly illustrate the fact that the PFI test can be no better than the capabilities of the examiners. Furthermore, the learning factor would certainly help to account for more valid scores; therefore, one or more practice sessions should precede the actual testing program.

REFERENCES

1. Clarke, H. Harrison. *Application of Measurement to Health and Physical Education.* New York: Prentice-Hall Inc., 1950.
2. Rogers, Frederick Rand. *Physical Capacity Tests in the Administration of Physical Education.* N. Y.: Bureau of Publications, Teachers College, Columbia Univ., 1926.
3. Fisher, R. H. *Statistical Methods for Research Workers.* 10th edition, London: Oliver and Boyd, 1946.

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Effects of Physical Training on Cardiac Output at Ground Level and at 15,000 Feet Simulated Altitude

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THERE HAVE BEEN only a few studies showing the *effects of physical training* on the cardiac output. One of the earlier studies by Henderson, et al (1), showed that athletes tended to have much slower pulse rates and larger stroke volumes than sedentary students. These investigators used the ethyl-iodide method to measure the cardiac output; hence, there is some doubt as to their findings.

Christensen (2) showed that the stroke volume increased with training when the intensity of the exercise was progressively increased. Dawson (3) likewise showed an increase in stroke volume with training but only indirectly, since the pulse pressure and the pulse rate pulse pressure product were used to estimate it.

Stewart and Watson (4) claim, however, that the greater stroke volume in athletes is relative, since by dividing out body weight no difference exists between athletes and non-athletes.

The majority of studies have shown either a comparison of athletes and non-athletes or have used rather inaccurate methods of measuring the blood flow. Because of this, there is some doubt as to the actual effects of training on the cardiac output.

Purpose of the Study

This study was conducted to show the effects of training on the cardiac output during a training program and to see if any changes made would be reflected in the reaction of the body to the stresses of high altitude. An interest in the effects of training on the ability to withstand high altitude is no new problem but very important with increasing importance of aviation.

Here also, there have been several studies showing the effects of altitude on the cardiac output, but the results have been somewhat varied. Helmholz (5), along with Starr and McMichael (6), showed that an increase occurred in the blood flow at high altitudes while Schneider (7), and Motley (8), reported that the blood flow decreased at high altitudes.

This study will add to this phase of investigation and at the same time attempt to throw some light on the possibility that the condition of the body may determine the reaction to altitude stresses.

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Subjects and Training Program

Three male graduate students in Physical Education at the University of Illinois were used as experimental subjects. The subjects were 22, 23, and 30 years of age and in sound physical health.

The subjects ran five days per week either on an indoor or outdoor track, depending upon the weather conditions. The running schedule was as follows:

Monday—jog ½ mile, two 880-yard runs, two 220-yard runs.
Tuesday—jog ½ mile, six 440-yard runs, two 220-yard runs.
Wednesday—jog ½ mile, one 2-mile run.
Thursday—jog ½ mile, four 440-yard runs, four 220-yard runs.
Friday—jog ½ mile, two 880-yard runs, two 440-yard runs.

Each week the schedule was intensified by having the subjects add one extra run to the daily program. Each of the runs was made at the subjects' maximum speed.

Testing Procedure

The subjects were taken to the laboratory and tested several times at ground level and at 15,000 feet simulated altitude, until they became accustomed to the procedure and acquainted with the equipment used. The subjects were tested in the mornings at 8 o'clock in the post absorptive state, i.e., at least 12 hours after a meal.

The ground level tests were given on Mondays and Wednesdays and the altitude tests were given on Tuesdays and Thursdays in a particular testing week. During a testing week, then, each subject was tested twice at ground level and twice at altitude. It would have been better to test at ground level and altitude on the same day, but this was impossible since other departments were using the decompression chamber and a limited time was given to each department.

In order to help offset the day-to-day fluctuations on the measurements, it was decided to test on alternate days and average the results found.

Fifteen thousand feet altitude (429 mm. Hg.) was reached at the rate of 1,000 feet per minute in a decompression chamber. This corresponds to the rate of climb in the average military plane and is the figure used in other similar studies (5, 6, 9, 10).

All the testing was done with a constant temperature of 78° F. and with relative humidity between 35 and 40 per cent.

The subjects were tested every four weeks during a 12 weeks' training program, then every four weeks during an eight weeks' detraining program.

The Grollman acetylene method was used to measure the cardiac output. The procedure was the same as described by Grollman (11), with the following exceptions:

1. The rebreathing was done at the rate of two respirations per five seconds as suggested by Chapman, et al. (12).
2. The samples of gas were taken at the end of the fourth and eighth expirations. Bansi and Groscurth (13) as well as McMichael, et al.

(14), showed that there is a homogeneous mixture after four respirations; thus, this procedure was used in order to complete the sampling before 20 seconds to avoid the main recirculation effects.

The O_2 intake needed for the cardiac output was determined by the Douglas Bag technique. All the gas analysis was done on a modified Haldane apparatus.

Reliability of the Testing

Twenty-six graduate students in physical education at the University of Illinois were tested twice—three to six weeks apart. The same procedure was used as was followed in this experiment. Table 1 shows the results of this testing.

TABLE 1

Results of Testing and Retesting Subjects in Circulatory Tests (3-6 Weeks Apart, N=26)

Measurement	Units	Reliability coefficient (r_{11})	Average per cent change	Average difference[1]	Av. diff.[2] / $\sqrt{N}$	Standard error of measurement[1] σ meas. diff. / $\sqrt{N-1}$
O_2 intake	cc/min.	.80	13%	33.5	19.37	13.57%
O_{2A-V} difference	cc/min.	.81	17%	14.2	8.20	17.73%
Minute volume	L./min.	.86	14%	.53	.31	14.62%
Stroke volume	cc./beat	.88	12%	6.8	3.93	12.52%
Pulse rate	beats/min.	.87	5%	3.0	1.73	5.22%
R.Q.	CO_2/O_2	.88	6%	.06	.035	6.26%

[1]Should be used to interpret the most probable error of a single observation.
[2]Most probable difference based on the average of 3 cases (*Cf.* H. M. Goodwin, *Elements of the Precision of Measurements and Graphical Methods*, New York: McGraw-Hill Co., 1920, pp. 16-17.

Findings

The changes made by the three subjects paralleled each other very closely. Because of this, and the space permitted, only the means of the changes are presented in Figure I. Since each subject was tested twice on each of the weeks tested, the mean points represent an average of six tests.

Minute Volume Changes

The minute volume in liters per minute decreased slightly during the first four weeks of training at both ground level and at altitude. Between the 4th and 12th week of training, the minute volume began to increase. At altitude during detraining the blood flow decreased, but at ground level continued to rise for the first four weeks of detraining before decreasing.

During training the minute volume increased 17.6 per cent at ground level and 5.96 per cent at altitude. Neither figure is very significant considering the 14 per cent average fluctuation found in measuring the minute volume (see Table 1). The gain at ground level was larger than the average variation

in the measurements, but is insignificant in the population reliability inference sense by Student's tables. But if we consider that the minute volume changed slowly and continued to increase during de-training, then the change becomes of greater importance.

An important change is seen when we look at the differences between the ground level and altitude minute volume. Before training the minute volume increased in all subjects when going from ground to altitude. The average rise was 17.6 per cent. At the end of training the minute volume increased in only one subject with the average rise being only 5.96 per cent. During detraining this change continued, until finally at the end of detraining the minute volume actually decreased slightly in all subjects as they went from ground level to 15,000 feet of simulated altitude. The effect of training developed more fully after the period of training ceased. This phenomenon has been observed in several associated cardiovascular studies, especially in the R- and T-waves of the ECG, which are usually higher after a few days

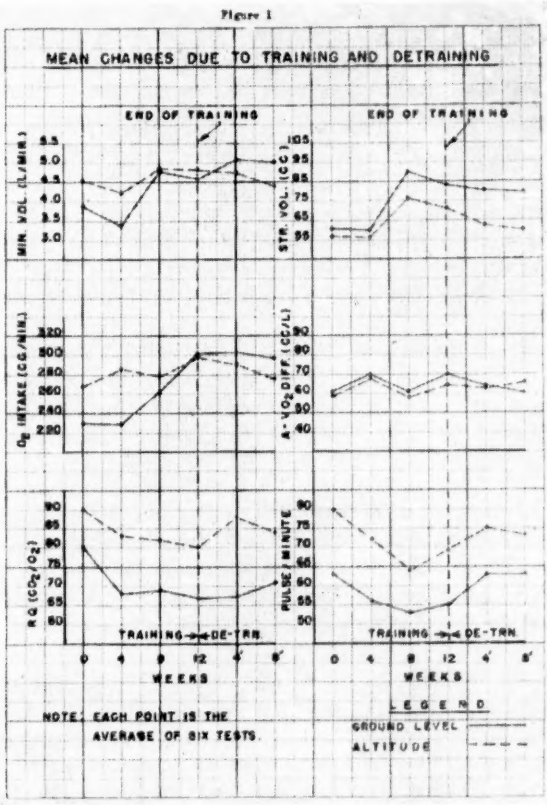

FIG. I. Mean Changes Due to Training and Detraining.

of rest when compared with those taken immedately at the end of the training period.

Stroke Volume Changes

The stroke volume after decreasing slightly during the first four weeks of training rose rapidly and reached a peak after eight weeks of training at the point where the pulse rate reached its lowest rate. At this point there was a gradual decrease which carried through to the end of de-training. The stroke volume, unlike the minute volume, decreased when going from ground to altitude before, during, and after training stopped. The increase in this measure was only slight in two of the subjects so that one subject caused the average decrease to appear larger than the actual picture.

The stroke volume of the heart increased 36.6 per cent at ground level and 26.0 per cent at altitude during 12 weeks of training. Even though the peak was reached at the end of eight weeks of training, the changes were significant at the 20-per-cent ($t = 2.91$) and 30-per-cent ($t = 2.07$) levels of confidence and can also be compared to the 12 per cent fluctuation of the measurement.[2] (See Table 1).

O_2-Intake Changes

The changes in the O_2-intake paralleled the minute volume very closely. The ground level O_2-intake rose during training and continued to increase during the first four weeks of detraining. At altitude, the increase continued during training and began to decrease at the start of detraining. As with the minute volume, the O_2-intake reversed its trend in all three subjects so that before and during training it increased between ground level and altitude, while during detraining there was a slight decrease in the O_2-intake when at altitude.

The O_2-intake increased 30.3 per cent ($t = 2.19$) at ground level during training and 12.4 per cent ($t = .902$) at altitude. The increase at ground level occurred with little or no weight change in the three subjects. The O_2-intake came about with a lowered ventilation and an increase in the "true"

Changes in the R.Q.

The R.Q. of each subject decreased during the training program and increased during detraining. The average drop during 12 weeks' training was 16.3 per cent ($t = 2.6$) at ground level and 11 per cent ($t = 1.8$) at altitude. These figures are significant at the 13- and 21-per-cent levels, respectively, but are about twice as large as the standard error of measurement[3]

[2]The t values are given but, owing to the fact that the experimental subjects were *not* randomly drawn, the values are not as useful as comparison with the *actual* errors of measurement. Any population inference cannot be very exact.

[3]The standard error of measurement based on the re-test data (Table 1) is taken as $\frac{\sigma}{\sqrt{N-1}}$ or 6.27 per cent; the obtained "t" values are 2.6 and 1.8 by R. A. Fisher's table (p. 53, Lindquist, *Statistical Analysis in Educational Research*).

and may also be compared to the 6 per cent average fluctuation of the measurement. (See Table 1).

Regardless of training, the R.Q. always increased when going to altitude, suggesting the same trend as any work load inducing a respiratory distress.

Pulse Rate Changes

The pulse rate decreased during training in all subjects, with the mean pulse rate reaching its low point after eight weeks of training. Both at ground level and altitude the pulse rate rose after eight weeks until the end of detraining.

The average decrease during training was eight beats per minute at ground level or 12.7 per cent ($t = 2.43$) and eleven at altitude or 13.7 per cent ($t = 2.6,$). By "Student's" tables, these t values are significant at the 15 per cent and 13 per cent levels, respectively.

Before training, the pulse rate rose an average of 17 beats per minute when going to altitude and rose only 11 beats per minute after eight weeks of training.

Summary of the Findings

In this study, three graduate students at the University of Illinois participated in an endurance running program for 12 weeks and then detrained for eight weeks. The quiet sitting cardiac output and related measurements of each subject were taken every four weeks both at ground level and at 15,000 feet simulated altitude.

From the results of this study the following summary of the findings is made:

1. During 12 weeks of training changes were made at ground level in the stroke volume, O_2-intake, pulse rate and R.Q. The stroke volume and O_2-intake increased while the R.Q. and pulse rate decreased. The changes are important when compared to the retest errors of measurement and cannot be strictly evaluated by the *t* test. In other words, the changes are important and significant as related to the errors of measurement for the subjects used but cannot be guaranteed by population sampling statistics because the subjects were not randomly drawn.
2. At altitude, only the pulse rate and R.Q. made changes as large as at ground level during training; however, the other changes made at altitude were in the same direction as those at ground level even though not as great.
3. During detraining, all the measurements reversed themselves at altitude, while at ground level the O_2-intake and minute volume didn't start to reverse and even increased until four weeks after training stopped. This "delayed rise" has been observed in other cardiovascular measurements.
4. The O_2-intake, minute volume, and stroke volume decreased slightly during the first four weeks of training indicating a possible fatigue effect not overcome for a month.
5. The R.Q., pulse rate, and stroke volume made similar changes when

going from ground level to altitude regardless of training; the R.Q. and pulse rate increased while the stroke volume always decreased at altitude. These changes presumably reflect the stress associated with going to altitude.

6. The effects of training were seen in the reduced reaction to the stress at altitude. Before training, the pulse rate increased 17 beats per minute going from ground to altitude, the heart minute volume increased and the stroke volume decreased, whereas, the O_2-intake increased to compensate for the anoxia at altitude. After training ended, the pulse rate rose only 11 beats, and the O_2-intake along with the heart minute volume reached a point where they no longer increased at altitude, the fatigue or stress effects being less noticeable, probably due to strengthening of the cardiovascular system by training. After training, the subjects still reacted to the stress at altitude but less effect was registered, as evidenced by the R.Q. and pulse rate measurements being approximately equal to those found at ground level before training. The trained subject thus had a greater margin of fitness at altitude.

REFERENCES

1. Henderson, Y., et al. The Efficiency of the Heart, and the Significance of Rapid and Slow Pulses, *American Journal of Physiology*, **82**: 512-524, 1927.
2. Christensen, E. H. Minutevolumen und Schlagvolumen des Herzens wahrend schwerer Koperlicher Arbeit, *Arbeitsphysiologie*, **4**: 470-502, 1931.
3. Dawson, P. M. Effect of Physical Training and Practice on the Pulse Rate and Blood Pressure During Activity and Rest, *American Journal of Physiology*, **50**: 443, 1919.
4. Stewart, W .H. and F. F. Watson. The Circulation in Athletes, *Journal of Clinical Investigation*, **19**: 35, 1940.
5. Helmholz, H. F., Bateman, and W. M. Boothby. Effects of Altitude Anoxia on Respiratory Processes, *Journal of Aviation Medicine*, **15**: 366-380, 1944.
6. Starr, I. and M. McMichael. O_2-Transport, Circulation and Respiration in Healthy Subjects at Simulated Altitudes of 16,000-18,000 Feet, *Journal of Applied Physiology*, **1**: 430-40, 1942.
7. Schneider, E. C., Dorothy Truesdell. The Circulatory Response of Man to Anoxia, *American Journal of Physiology*, **71**: 90-105, 1924.
8. Motley, H. L., et al. The Influences of Short Periods of Induced Acute Anoxia Upon Pulmonary Arterial Pressures in Man, *American Journal of Physiology*, **150**: 315-24, 1947.
9. Hoff, E. C. and J. F. Fulton. *A Bibliography of Aviation Medicine*, Baltimore: C. C. Thomas Co., 1942. Pp. 237.
10. ———. *Notes on Physiology in Aviation Medicine*, Washington, D. C.: T.M. 8-310, War Department, pp. 95.
11. Grollman, Arthur. *The Cardiac Output of Man in Health and Disease*, Springfield Ill.: C. C. Thomas Co., 1932. Pp. 325.
12. Chapman, C. B., et al. Simultaneous Determination of the Resting Arterio-Venous Oxygen Differences by the Acetylene and Direct Fick Methods, *The Journal of Clinical Investigation*, **29**: 651-59, 1950.
13. Bansi, H. W. and C. Groscurth. Die Bestimmung des Zerkulatorischen Minutenvolumens mittels Acetylene in der Rühe and die Arbeitsversuchen, *Zeitschrift für die gesampte Experimentelle Medizin*, **77**: 631-40, 1931.
14. McMichael, J., et al. Postural Changes in Cardiac Output and Respiration in Man, *Quarterly Journal of Experimental Physiology*, **27**: 55-71, 1931.

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Inter-relation of Maximum Pulse Rate During Moderate Exercise, Recovery Pulse Rate, and Post-Exercise Blood Lactate

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NOT INFREQUENTLY, achievements in sports and successful performance in emergencies demand a high level of respiratory and cardiovascular fitness. It is not surprising, therefore, that physical educators and athletic coaches have been intimately concerned with the development of these physiological systems. It follows that techniques for measuring the effectiveness of recreational and training programs as they contribute to such development are indispensable. A method of securing physiological data of a subject's response to stress should be useful to the average coach or physical education teacher.

The simplicity and practicability of the Harvard Step Test (5) justifies exhaustive investigations of its validity. The "Recovery Index," sometimes called the "Fitness Index," as employed in this test is defined as follows:

$$\text{Recovery Index} = \frac{\text{duration of exercise (in seconds)} \times 100}{2 \times \text{sum of pulse counts in recovery}}$$

This index has been called the Harvard Step Test Score because the exercise generally employed requires the subject to step onto a 20 inch bench at a rate of 30 steps per minute up to a maximum of 5 minutes. Brouha and his co-workers, however, have used other forms of exercise including treadmill running (20), pedalling a bicycle ergometer (13), rowing (4), and pulling a weight which is proportional to the body weight of the subject (20). Within certain limits the form of exercise probably is not important insofar as the physiological interpretations are concerned (20).

Shortly after the Harvard or Five-Minute Step Test was introduced (20), additional evidence appeared to support its validity as a measure of circulatory efficiency (7, 14). Scores were reported for 21 varsity oarsmen on maximum exercise pulse rate, post-exercise pulse rate (Recovery Index) and post-exercise blood lactate for a five minute run on the treadmill at seven miles per hour, 8.6 per cent grade. Maximum pulse rates were recorded continuously by means of a cardiotachometer. Blood samples for lactate determinations were taken five minutes after the end of exercise. Individual and mean scores were given for the subjects before and after a 12-week training period.

Gallagher and Brouha (14) originally presented these data to show concomitant improvement in the Recovery Index and other measures. With the authors' permission, their data were analyzed further and the results constitute the basis of this report.

Results

Since all subjects, even before training, completed the five minute run, the Recovery Index represents only their post-exercise pulse rates. Thus:

$$\text{Recovery Index} = \frac{(300 \text{ sec.})\ 100}{2\ (\text{sum of recovery pulse counts})} = \frac{15{,}000}{\text{sum of recovery pulse counts}}$$

An analysis of the data is presented in Tables 1 through 4.

TABLE 1

Descriptive Statistics for Recovery Index, Lactate and Pulse Rate Measurements on 21 Oarsmen

Before 12-weeks Training

Measurement	Mean	σ	Range
Recovery Index	86.67	17.1	65-156
Lactate (mgr./100 cc. blood)	104.57	28.8	53-166
Max. Pulse Rate (Beats/min.)	191.29	8.3	172-205

After 12-weeks Training

Measurement	Mean	σ	Range
Recovery Index	102.95	20.3	75-181
Lactate (mgr./100 cc. blood)	80.43	21.8	41-142
Max. Pulse Rate (Beats/min.)	176.81	8.6	158-195

TABLE 2

Effect of Training on Recovery Index, Lactate and Pulse Rate Measurements on 21 Oarsmen

Measurement	Mean Improvement[1]	σ	t	P[2]
Recovery Index	+16.28	6.6	11.0	>.001
Lactate (mgr./100 cc. blood)	−24.14	18.2	5.9	>.001
Max. Pulse Rate (Beats/min.)	−14.48	6.9	9.3	>.001

[1]Minus values indicate negative change; i.e., the scores decreased with training.
[2]Probability that improvement is due to chance.

TABLE 3

Intercorrelation of Recovery Index, Lactate and Pulse Rate Measurements on 21 Oarsmen

Before 12-weeks Training

Measurement	r	P[1]
Recovery Index and Lactate	—.470	.02
Recovery Index and Max. Pulse Rate	—.637	.00
Lactate and Max. Pulse Rate	.131	.56

After 12-weeks Training

Measurement	r	P[1]
Recovery Index and Lactate	—.722	.00
Recovery Index and Max. Pulse Rate	—.782	.00
Lactate and Max. Pulse Rate	.665	.00

[1]Probability that the computed coefficient represents a chance deviation from zero. From Fisher's z-tables.

TABLE 4

Partial and Multiple Correlation Coefficients for Recovery Index (1), Lactate (2), and Pulse Rate Measurements (3) on 21 Oarsmen

Variables Correlated	Partial Correlation Coefficient	P[1]
$r_{12.3}$ (Before training)	—.507	.02
$r_{13.2}$ (Before training)	—.657	.00
$r_{12.3}$ (After training)	—.434	.05
$r_{13.2}$ (After training)	—.521	.02
$r_{1.23}$ (Before training)	.902	.00
$r_{1.23}$ (After training)	.733	.00

[1]Prabability that the computed coefficient represents a chance deviation from zero. From Fisher's z-tables.

Discussion

The results described in Table 2 indicate that post-exercise pulse rate (Recovery Index) is sensitive to a training program. This has been previously demonstrated and discussed by Gallagher and Brouha (14) and Brouha and Savage (7). Other data also substantiate these results (15, 16, 20). In the present study, maximum pulse rate and blood lactate both decreased with training.

The statistically significant correlation coefficients of Table 3 indicate that Recovery Index reflects maximum pulse rate and post-exercise blood lactate.

This confirms other results in the form of scatterdiagrams (13). The coefficients between maximum pulse rate and Recovery Index were higher (—0.637 and —0.782) than the coefficient of —0.32 reported by Hodgson (18). With so few subjects in her study (13 college women), the sampling error is quite large. This could account for the discrepancy.

That the association between Recovery Index and lactate cannot be entirely explained by the correlation of Recovery Index and maximum pulse rate is illustrated by the partial correlation coefficients of Table 4. Similarly, when the effect of lactate is partialled out, the relationship between Recovery Index and maximum pulse remains significant. Since maximum pulse rate was taken during the run, it obviously reflects adjustment to exercise. Lactate was measured five minutes after termination of exercise and could measure recovery rate as well as exercise adjustment. This would explain the significant partial correlation coefficients and supports the suggestion by Brouha, *et al.* (6) that the Recovery Index reflects adjustment to *and* recovery from exercise.

The value of blood lactate level after sub-maximal exercise as a measure of fitness has been studied extensively. Crescitelli and Taylor (9) and Astrand (2, *Ch. VIII*) summarize much of this literature. The evidence is convincing that trained endurance athletes, after a standard exercise, exhibit lower blood lactates than do subjects in a poorer state of training (3, 8, 9, 10, 19). Ample evidence is also available that an athletic program or daily hard manual labor will result in the accumulation of less lactate following a fixed task (11, 15, 2 p. 92, 22, 24). These effects are apparently reversible (11). There is little doubt that part of the reduction in lactate is due to increased efficiency—that is, a reduction in 0_2-requirement (4, 17, 23, 24)—but it probably also reflects a greater proportion of energy from aerobic processes (24). Miller and his associates (21), for example, observed only one significant physiological effect of 0_2 administration during sub-maximal exercise, namely a decrease in post-exercise lactate.

Training results in a lowered maximum pulse rate during a standardized exercise (9, 12, 15, 16, 26) and this effect too appears to be reversible (26). It is interesting to note that of the various physiological measurements taken by Taylor (25) during and after moderate exercise, maximum exercise pulse rate and post-exercise lactate correlated highest with "all-out" run times (—0.56 and —0.44, respectively).

In the present study, the correlation coefficients among Recovery Index, maximum pulse rate, and lactate were larger in every instance after a period of training. The difference was significant (1% level) only for the correlation of maximum pulse rate and lactate. The explanation for the low correlation of these two variables before training is not apparent. However, many details of the lactate mechanism are not clear. There is not agreement, for example, whether blood lactate levels off during sub-maximal exercise (9), whether maximum lactate occurs before or after the exercise (9), or how the

0_2— tension of the inspired air affects 0_2— debt and post-exercise blood lactate (1).

It is generally not feasible for the coach or teacher to measure maximum pulse rate or post-exercise blood lactate directly. However, if the data of Gallagher & Brouha are typical, Recovery Index reflects these physiological measures surprisingly well. *The results are all the more encouraging since the sample comprises only varsity athletes!* Such a homogeneous group generally exhibits a relatively small variance and consequently tends to decrease the magnitude of the coefficients of correlation. It is reasonable to assume that a more heterogeneous sample would yield even higher coefficients. Furthermore, since the reproducibility of lactate measurements is relatively poor (25), appreciable attenuation may be present. Eliminating errors of measurement would conceivably further increase the correlations involving lactate determinations.

Summary

Gallagher and Brouha (7, 14) reported maximum pulse rates, post-exercise blood lactates and Recovery Index scores following sub-maximal exercise for 21 oarsmen. Scores before and after a training program were presented. These data were analyzed to determine the correlation between (1) Recovery Index and maximum pulse rate and (2) Recovery Index and blood lactate. The coefficients were significant at or above the 2% level in every instance, both before and after training. Partialling out the effect of one variable did not eliminate the correlation between the other two.

REFERENCES

1. Asmussen, E. W. V. Döbeln, and M. Nielson, Blood Lactate and Oxygen Debt after Exhaustive Work at Different Oxygen Tensions, *Acta Physiologica Scandinavica*, **15**: 57-62, 1948.
2. Astrand, Per-Olof. *Experimental Studies of Physical Working Capacity in Relation to Sex and Age*. Copenhagen: Ejnar Munksgaard, 1952. 171 pp.
3. Bock, A. V., *et al.* Studies in Muscular Activity. III. Dynamical Changes Occurring in Man at Work, *Journal of Physiology*, **66**: 136-61, 1928.
4. Brouha, Lucien. Spécificité de l'entraînement au travail musculaire, *Revue canadienne de Biologie*, **4**: 144-8, 1945.
5. ———. The Step Test: A Simple Method of Measuring Physical Fitness for Muscular Work in Young Men, *Research Quarterly*, **14**: 31-6, 1943.
6. ———, A. Grabiel, and C. W. Heath. The Step Test: A Simple Method of Measuring Physical Fitness for Hard Muscular Work in Adult Man, *Revue canadienne de Biologie*, 2:86-92, 1943.
7. ———, and B. M. Savage. Variability of Physiological Measurements in Normal Young Men at Rest and During Muscular Work, *ibid.*, **4**: 131-43, 1945.
8. Cook, L. C., and R. H. Hurst. Blood Lactic Acid in Man During Rest, *Journal of Physiology*, **79**: 443-54, 1933.
9. Crescitelli, F., and C. Taylor. The Lactate Response to Exercise and Its Relationship to Physical Fitness, *American Journal of Physiology*, **141**: 630-640, 1944.
10. Dill, D. B., J. H. Talbott, and H. T. Edward. Studies in Muscular Activity. VI. Response of Several Individuals to a Fixed Task, *Journal of Physiology*, **69**: 267-305, 1930.

11. Edward, H. T., L. Brouha, and R. T. Johnson. Effets de l'entraînement sur le taux l'a. Lactique sanguin au cours du travail musculaire, *Le Travail Humain*, **8**: 1-9, 1940.
12. Erickson, *et al.* "The Energy Cost of Horizontal and Grade Walking on the Motor-Driven Treadmill, *American Journal of Physiology*, **145**: 391-401, 1946.
13. Gallagher, J. R., and L. Brouha. I. Dynamic Physical Fitness in Adolescence. *Yale Journal of Biology and Medicine*, **15**: 657-70, 1943.
14. ———. Physical Fitness: Its Evaluation and Significance, *Journal of the American Medical Association*, **125**: 834-8, 1944.
15. ———. II. The Evaluation of Athletic Programs by Means of Fitness Tests. *Yale Journal of Biology and Medicine*, **15**: 671-7, 1943.
16. Gallagher, J. R., C. D. Gallagher, and L. Brouha. IV. The Evaluation of a Body-Building Program Utilizing a Bicycle Ergometer Test, *ibid.*, **15**: 689-92, 1943.
17. Gould, A., and J. Dye. *Exercise and Its Physiology*. New York: A. S. Barnes Co., 1932. 434 pp.
18. Hodgson, P., *et al.*, Study of Some Relationships between Performance Tests and Certain Physiological Measures Associated with Maximal and Submaximal Work. *Research Quarterly*, **17**: 208-224, 1946.
19. Johnson, R. E., and L. Brouha. Pulse Rate, Blood Lactate and Duration of Effort in Relation to Ability to Perform Strenuous Exercise, *Revue canadienne de Biologie*, **1**: 171-8, 1942.
20. ——— and R. C. Darling. A Test of Physical Fitness for Strenuous Exertion, *ibid.*, **1**: 491-503, 1942.
21. Miller, A. T., *et al.* Influence of Oxygen Administration on Cardiovascular Function During Exercise and Recovery, *Journal of Applied Physiology*, **5**: 165-8, 1952.
22. Owles, W. H. Alternations in Lactic Acid Content of the Blood as a Result of Light Exercise, and Associated Changes in the CO_2-Combining Power of the Blood and in the Alveolar CO_2 Pressure. *Journal of Physiology*, **69**: 314-37, 1930.
23. Robinson, S., and P. M. Harmon. The Effects of Training and of Gelatin upon Certain Factors which Limit Muscular Work, *American Journal of Physiology*, **133**: 161-9, 1941.
24. ———. The Lactic Acid Mechanism and Certain Properties of the Blood in Relation to Training, *ibid.*, **132**: 757-69, 1941.
25. Taylor, C. Some Properties of Maximal and Submaximal Exercise with Reference to Physiological Variation and the Measurement of Exercise Tolerance, *ibid.*, **142**: 200-212, 1944.
26. Taylor, H. L., *et al.* The Effect of Bed Rest on the Blood Volume of Normal Young Men, *ibid.*, **144**: 227-32, 1945.

(Submitted 6-1-53)

Classification of Emory University Male Freshmen in Physical Education Classes

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THERE IS GENERAL agreement among physical educators that effective teaching can be much more readily accomplished where classification of students is made in accordance with some type of homogeneous grouping. Sample quotations include:

> At the beginning of a season the teacher may want a measure of status of all individuals in the class to use as an aid in determining instructional groupings within a class.[1]
>
> Equating the powers or abilities of individuals and groups is necessary to obtain the greatest benefits from physical activity programs.[2]

Acting upon this conviction, members of the Department of Physical Education of Emory University have administered for the past four years (fall of 1949 through fall of 1952) an eight-item classification test to incoming male Freshmen. The purpose of the test has been to facilitate the classification of students so that they may participate in groups as homogeneous in nature as can be arranged.

The items which make up the test were selected because they were felt to be pertinent to the activities taught in the required program of physical education. Many of these activities also appear in the voluntary intramural and intercollegiate athletic programs. It should be noted here that this test is the means for classification for all activities with the exception of swimming. Each Freshman male student at Emory University spends one term swimming. The classification for this is based upon a boy's time for the 50-yard swim. Three groupings are made here so that all of the best swimmers are together, the average swimmers are grouped together, and the poor or non-swimmers receive their instruction as a group.

Statement of the Problem

Based upon the experience and critical evaluation of the members of the physical education department of Emory University, the test may be said to be meeting its objective; that is, the groupings have, for the most part, resulted in a homogeneity of performance level. The question which arose, however, was whether there might be repetition within test items. In other words, was the same skill being measured more than once and, if so, might not the same results be obtained through fewer test items?

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[1]M. Gladys Scott and Esther French, *Evaluation in Physical Education*, St. Louis: The C. V. Mosby Co., 1950, p. 18.

[2]H. Harrison Clarke, *Application of Measurement to Health and Physical Education*, New York: Prentice-Hall, Inc., 1950 (2nd ed.), p. 252.

The eight items comprising the classification test for activities other than swimming are listed and described below:

1. *Chinning.* A regulation chinning bar is used. The student may utilize whichever grip he prefers on the bar and is governed by a few regulations. He must pull up to a height sufficient for his chin to reach over the bar. Next, he must straighten his arms completely when dropping to the lower part of the exercise. Finally, he must pull his body in a straight upward direction, unaided by body swing or leg kick of any sort. The chins are scored by multiplying the student's weight by the number of times he has chinned himself to give a total of the weight lifted. This figure is then divided by 20 to arrive at the chinning strength score.

2. *Sargent Jump.* Here the student is instructed to stand facing a jumping board. He holds a piece of chalk in one hand and, while standing flat on the floor, he raises both arms above his head. At the top of his reach, he makes a mark on the board with the chalk. Then, facing in a sideways direction, he bends his knees, swings his arms down and to the rear, and jumps as high as possible off the floor. At the peak of his jump, he extends his arm fully and makes a mark on the board. The distance between the two marks represents his jump. Each person is given two jumps and the better of the two is measured. Measurement is to the nearest half-inch.

3. *Sixty-yard Dash.* This is a run in which each contestant is timed from start to finish, with the time being recorded to the nearest tenth of a second.

4. *Softball Throw.* Students are permitted two throws, with the better of the two measured to the nearest foot. The starting point is represented by a peg or line. Stepping over the line disqualifies the throw. A single-step throw, followed by a follow-through step with the opposite foot, is prescribed.

5. *Football Throw.* This is administered exactly as the softball throw.

6. *Basketball Dribble.* Four chairs are set at equal distances and staggered right and left three feet to either side of a line running from one basket to the other. On a given signal, the participant who is at the end line under the basket starts dribbling to the right. He goes to the outside of each chair and, when he gets to the far end, shoots for that basket. He shoots until the ball goes in the basket and then starts back. On the return trip, he again starts dribbling to his right. He dribbles to the outside of each chair and upon reaching the other basket shoots at it until he scores. His score is determined by the time which has elapsed from the starting signal until he has scored at the second basket. The time is recorded to the nearest tenth of a second. The length of our courts is 86 feet.

7. *Volleyball Serve.* A variation of the Russell-Lange volleyball serve test is used with a standard volleyball court and net. The receiving side of the court is marked off into seven zones with scores running from one to five assigned to each of the zones. After one practice serve, the student is given five serves with his score the cumulative total of the scores obtained by each of the five serves. A serve which hits the ceiling, goes into the net, or lands

outside the court receives a score of zero. "Let" serves, or serves which hit the top of the net and drop over into the receiving area, are replayed. Balls hitting on lines are awarded the score of the zone adjacent to that line which carries the highest value.

8. *Soccer Dribble.* Pegs are used for both starting and finishing points. Five yards from the starting peg and five feet to the right of a straight line between the pegs, a chair is placed. Fifteen yards from the starting peg and five feet to the left of the same straight line, a second chair is placed. The third chair is located 25 yards from the starting point and directly behind the first chair. A fourth chair is placed 35 yards from the starting peg and directly behind the second chair. Five yards farther on is the peg to mark the finish. Upon receipt of a starting signal, the contestant starts to dribble the ball with his feet, going to the outside of each chair and going past the finish point with the ball in his control. The elapsed time between starting signal and the crossing of the finish point with the ball is measured to the nearest tenth of a second.

The method of converting the number of chins accomplished into a chinning strength score has already been described. For the seven other tests, frequency tables for each test were constructed and percentiles determined therefrom. Over 900 scores are included in each of the seven tables. An individual's converted score on any given test item is then easily obtained by determining at what percentile his performance on that test places him. Once the converted scores have been obtained for each of the eight test items, the student's total motor ability score is then derived through the simple process of totaling all eight scores and obtaining the mean thereof.

Procedure

The Wherry-Doolittle Test Selection Method provided the instrument for analysis of the items which make up the test. As described by Garrett, "By use of the Wherry-Doolittle method we can (1) select those tests which yield a maximum R with the criterion and discard the rest; (2) calculate the multiple R after the addition of each test, stopping the process when R no longer increases."[3] This coincides with the intent of our study.

Since there was general agreement as to the over-all effectiveness of the total motor ability score as a means of classification, this score was used as the criterion. By means of the product-moment method, correlations of the criterion measure with each of the eight test items were computed. Additionally, intercorrelations of each test item with each of the other seven were derived. The data for these correlations were derived from the scores obtained by 220 entering Freshmen at Emory University in the fall of 1952. The correlations obtained are given below.

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[3]Henry E. Garrett, *Statistics in Psychology and Education*, New York: Longmans, Green and Co., 1947 (3rd Ed.), p. 435.

	1	2	3	4	5	6	7	8	
C	.788	.768	.733	.685	.681	.665	.533	.391	Total Motor Ability Score
1		.784	.411	.463	.512	.460	.392	.169	Softball Throw
2			.331	.464	.441	.518	.299	.191	Football Throw
3				.328	.332	.339	.182	.178	Sargent Jump
4					.467	.239	.317	.132	Sixty-yard dash
5						.367	.222	.127	Chinning
6							.389	.141	Basketball Dribble
7								.191	Soccer Dribble
8									Volleyball Serve

Analysis

With the first selected test, the softball throw, a multiple R of .788 with the criterion is obtained. The second selected test, chosen in accordance with the statistical rules of the Wherry-Doolittle Method, is the sargent jump, through the addition of which the multiple R is raised to .906. The 60-yard dash is the third selected test and its addition increases the multiple R to .951. The addition of the fourth test item, the basketball dribble, results in a multiple R of .987.

Because additional test items do not increase the multiple R, it is concluded that the four test items mentioned above constitute a battery with the highest validity of any combination of test items selected from the list of eight.

Conclusion

Examination of our classification test by the Wherry-Doolittle Test Selection Method enables us to shorten considerably the amount of time required for testing without sacrificing the effectiveness of the test. Where eight items formerly comprised the test, the above-mentioned four items give virtually the same result. Thus savings in time and in testing personnel and materiel are effected.

(Submitted 2-3-53)

A Golf Knowledge Test

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THE TEST (see Appendix, page 466) used in this study to measure the extent of an individual's knowledge of golf has been in use for several semesters. It has served as a final examination in determining the extent of knowledge and the grading of the students in the Required Physical Education Program at the University of Florida.

The course in golf consists of a 15-week period, meeting for two one-hour periods per week. The hundred students used in this study were from four different classes which were taught by different instructors. Included in the 100 students were four foreign students from South America whose native language was Spanish.

The teaching of golf is done through lectures, motion picture slides, demonstration, practice, and critical analysis by the instructor. In addition to the test of golf knowledge, the students are also given a skill test in achievement, using the following items: putting, chip shot, pitch shot, short iron, and drive.

This study is concerned with presenting the criteria for judging the golf knowledge test, and it is not concerned with the method of teaching or the skill test used to measure golf achievement.

Validity of the Test

Test items were taken from prominent books (1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15) on golf. The pertinent information for the student was condensed from the golf books into shorter form, consolidated, and mimeographed. Each student taking the course was given a copy of this student information.[1]

Reliability of the Test

A correlation of the scores was based on the results of giving the golf knowledge test to a group of 100 men. The reliability coefficient of the odd-even test was found to be .70. The reliability of the whole test was obtained by applying the Spearman-Brown Formula to the reliability coefficient of the odd-even test and was found to be .82.

Item Analysis

In determining the worth of individual questions which constitute the written test, the individual questions should be subject to analysis. This evaluation is called item analysis. The reason for doing this is to select the best questions and discard or rewrite the ones which indicate a need for revision.

[1] A copy of the student information will be furnished by the authors to those requesting it.

1. *Difficulty Rating.* In the analysis of items, it is desirable to know just how difficult each of the questions proved to be for those taking the test. The difficulty rating of a question is obtained by dividing the number of correct responses by the number who took the test, and express as a percentage. Therefore, the lower the difficulty rating, the more difficult the question. Ideally, the items should range from about 10 to 90.

The difficulty rating of the items is given in the first column of the test (see Appendix, page 466).

2. *Index of Discrimination.* The worth of an item on a written test not only depends upon its difficulty but also upon its ability to discriminate between the high and low levels of achievement. A test item is said to have a perfect discriminating function when all students who answer the question perfectly rank higher in the entire test than the students who answer it incorrectly. A test item is said to have a negative discriminating power and to be a poor question when students of low ability answer the questions correctly and students of high ability do not answer it correctly. Between the extremes of being a perfect discriminating item on the test and one of having a negative discriminating power, items of all degrees of discrimination are found.

The point at which items are accepted or rejected depends upon how critical one is and the significance which is to be placed on the test score in the use of the examination. An index of 20 or more is usually required of a test item. However, Scott and French indicate that indices of 16 to 19 are usually discarded with some items retained if the difficulty level is satisfactory.

The index of discrimination—Flanagan Index of Discrimination—can be found in column two of the test (see Appendix, page 466).

Norm Tables

The mean score was 56.14 for the golf knowledge test based on the 100 men tested, with a range of scores from 14 to 81 and a standard deviation of 13.20.

Table 1 gives the assignment of marks based on the standard deviation technique and the percentage technique (2).

TABLE 1

Assigning Letter Marks for Golf Knowledge Test Scores

Standard Deviation Technique				Percentage Technique			
Letter	Scores	No.	%	Letter	Scores	No.	%
A	75.94-up	5	5	A	75-up	6	6
B	62.74-75.94	43	43	B	67-74	20	20
C	49.54-62.74	28	28	C	52-66	46	46
D	36.34-49.54	15	15	D	31-51	22	22
E	down-36.34	9	9	E	down-30	6	6

In order to combine the golf knowledge test scores with other scores to arrive at a semester mark, T-scale scores were established for the group of 100 students (Table 2).

TABLE 2

T-Scores for Golf Knowledge Test

Scores	T-Scores	Scores	T-Scores
81	75	56	45
77	72	55	45
76	68	54	44
75	66	51	44
73	65	50	43
72	63	48	42
71	62	47	42
70	61	46	41
69	60	44	40
68	58	42	39
67	57	40	38
66	55	39	37
65	53	35	36
64	52	34	36
63	51	31	35
62	50	30	34
61	49	28	33
60	48	26	31
59	47	25	28
58	46	14	24
57	46		

Summary and Conclusions

1. This study presents certain criteria to be used in judging a golf knowledge test for college students.

2. An objective test consisting of 100 true-false questions was administered to four classes taught by four different instructors.

3. The reliability of the test was found to be .82.

4. The difficulty rating and the index of discrimination of the true-false questions are given.

5. In general the test items appear to have high difficulty ratings, indicating that the questions could be made more difficult.

6. Certain test items which do not measure up to item analysis standards on the basis of difficulty rating and/or index of discrimination need revision.

7. Norm tables are presented for the objective golf test.

REFERENCES

1. Dresser, Henry. *A Manual for Golf Instruction.* Unpublished Doctor's dissertation, New York University, New York, 1937. 120 pp.

2. Greene, Harry A., Albert N. Jorgensen, and J. Raymond Gerberich. *Measurement and Evaluation in the Secondary School.* New York: Longmans, Green and Co., 1946. pp. 585-589 and pp. 617-622.
3. Hicks, Betty, and Ellen J. Griffin. *Golf Manual for Teachers.* St. Louis: C. V. Mosby Company, 1949. 312 pp.
4. Hogan, Ben. *Power Golf.* New York: A. S. Barnes and Company, 1948. 166 pp.
5. Labrichsen, Milton. *Comparative Analysis of Some Putting Methods.* Unpublished Master's thesis, New York University, New York, 1937. 63 pp.
6. Martin, H. B. *Golf for Beginners.* New York: Modern Sports Publishing Co., 1930. 95 pp.
7. Menke, Frank G. *The New Encyclopedia of Sports.* New York: A. S. Barnes and Co., 1944, 1947. pp. 505-524.
8. Mitchell, E. D. *Sports for Recreation.* New York: A. S. Barnes and Co., 1936. pp. 146-166.
9. Morrison, Alex J. *A New Way to Better Golf.* New York: Simon and Schuster, Inc., 1932. 187 pp.
10. Murphy, Mary Agnes. Criteria for Judging a Golf Knowledge Test. *Research Quarterly* **4**: 81-88, 1933.
11. Nelson, Byron. *Winning Golf.* New York: A. S. Barnes and Co., 1946. 192 pp.
12. Runyan, Paul. *Golf Is a Game.* New York: Calvert Distiller's Corp., 1939. 25 pp.
13. Scott, M. Gladys, and Esther French. Evaluation in Physical Education. St. Louis: The C. V. Mosby Co., 1950. pp. 281-294, 317-329.
14. Snead, Sam. *How to Play Golf.* Garden City, New York: Garden City Publishing Co., Inc., 1946. 173 pp.
15. Vardon, Harry. *Gist of Golf.* New York: H. Doran and Co., 1922. 250 pp.

APPENDIX

Golf Knowledge Test

Do not mark this test. Place your answers on the answer sheet and return both to the instructor. If the statement is false or partially so, encircle the "F" on the answer sheet. If the statement is wholly true, encircle the "T" on the answer sheet. (Right minus wrong).

Difficulty Rating[1]	Index of Discrimination[2]	Need Revision	Answer	No.
90	43		F	1. Golf originated as a definite game about the 12th century.
88	14		F	2. In a closed stance the left foot is pulled back from the line of flight.
46	40		F	3. Queen Ann of Scotland was the first woman golfer of whom there is any mention.
44	—12	•	T	4. In the game of golf, bent grass is most commonly used on the putting greens.
87	0	•	T	5. The term "cadet" in the early history of golf meant someone who was learning the game.
43	11	•	F	6. A rigid left arm is necessary in driving.
84	66		T	7. In 1457 the Parliament of Scotland ruled against the playing of golf.
78	60		F	8. The stance for the chip shot is quite close.

Difficulty Rating[1]	Index of Discrimination[2]	Need Revision	Answer	No.
84	19		T	9. The first golf tournament of which there is any record was played at Preswick, Scotland, in 1860.
67	55		F	10. It is one of the caddie's jobs to see that all holes in a bunker are filled.
96	23	•	T	11. John G. Reid is known as the "Father of American Golf."
87	19		T	12. Number 1, 10 tee and 9, 18 green are always located near the clubhouse.
89	63		F	13. The amateur ruling body for golf in the United States is known as the American Association for Golf.
85	57		F	14. The spoon is in a set of golf clubs but is very seldom used.
94	57		T	15. The Professional Golfers Association is the ruling body for all professional tournaments.
66	25		F	16. In playing the pitch shot to the green, the ball is played with the club face closed.
63	51		F	17. The P.G.A. was formed in the year 1920.
65	—24	•	T	18. Gripping the golf club too tensely generally causes shanked shots.
21	—05	•	F	19. The first golf tournament held in the United States was staged at Newport, Rhode Island, in 1894.
78	28		T	20. In golf when you have a smothered shot, it is generally caused when the face of the club is closed too much at impact.
73	77		F	21. The early golf balls were made of feathers tightly stuffed into a crude rubber cover.
79	15		T	22. The most common reason for a person to slice is cutting across the ball at impact.
88	57		T	23. About 1925 manufacturers began to produce tempered steel shafts.
84	40		T	24. The pendulum and hinge are two basic methods of putting.
34	— 3	•	T	25. The Curtis Cup matches are for women only.
92	36		F	26. The three stances in golf are open, closed, and wide.
54	51		F	27. Harry Vardon, Ted Ray, and Francis Ouimet were three famous early golf professionals.
87	30		T	28. Over 95% of golfing authorities teach or use the overlapping grip.
85	32		T	29. A golfer can only legally carry 14 clubs.
71	03	•	T	30. The average golfer takes about 100 to 110 strokes for 18 holes.
87	57		F	31. A golf hole should be 4½ inches in diameter and sunk at least 6 inches deep.
54	43		F	32. The expression "two up" refers to medal play.
86	53		T	33. The course is known as the whole area in which play is permitted.
74	56		F	34. A driver is generally used on the fairway.

Difficulty Rating[1]	Index of Discrimination[2]	Need Revision	Answer	No.
96	09	•	T	35. A golf ball is out of bounds when it comes to rest on ground on which play is prohibited.
91	43		T	36. The number 7, 8, and 9 irons are known as the short irons.
94	49	•	F	37. A ball is lost if it is not found within 6 minutes after search for it has begun.
66	17		T	38. In the game of golf two putts are par for a green
94	30	•	T	39. "Rub of the Green" means that when a golf ball is in motion, it is stopped or deflected by any outside agency.
96	30	•	T	40. In golf for long shots the wooden or the low numbered irons are used.
92	49		F	41. Match and medal play are the same.
97	35	•	F	42. In executing a golf swing, the knees are straight and the grip is tense.
97	43	•	T	43. Honor is the right to play first from the tee.
73	34		F	44. The interlocking grip is the most widely used.
91	53		F	45. A "Birdie" is two under par.
75	24		F	46. The playing of two balls off the starting tee is never ethical.
17	09	•	F	47. A hazard is any bunker, trap, permanent water ditch, sand, or woods.
82	—33	•	T	48. Four major divisions of a golf course are fair ways, greens, rough, and traps.
86	44		F	49. A "slice" is a shot which curves to the left of a right handed player.
85	48		T	50. Broyles Pelmons is the golf pro at the Gainesville Golf and Country Club.
74	13	•	T	51. The term "fore" is a signal to warn golfers that a ball has been driven in their direction.
83	57		T	52. A "Referee" is a person who is appointed by the Rules Committee.
90	53		F	53. An "eagle" is one over par.
77	60		T	54. You may brush across the line of your putt without penalty.
56	06	•	T	55. The person who authorizes you to begin play is known as the starter.
82	20		F	56. You cannot move your ball from an artificial obstruction without a one or two strokes penalty.
73	24		F	57. There are four tee markers on each side.
34	08	•	F	58. There is a one stroke penalty when you hit a ball from the tee into a water hazard.
71	38		F	59. A brassie is a No. 3 wood.
94	43	•	F	60. If the ball falls off the tee before you have taken your swing, you may replace it and there is a one stroke penalty.
93	49		T	61. Casual water is the temporary accumulation of water which is not recognized as a hazard on the course.
81	—01	•	F	62. When you hit a ball out of bounds, there is no penalty.

Difficulty Rating[1]	Index of Discrimination[2]	Need Revision	Answer	No.
24	20		F	63. The neck of a golf club is the point at which the shaft joins the head of the club.
84	24		F	64. When you miss the ball, there is no penalty.
91	53		T	65. To pull a ball means to hit the ball straight but to the left of the line of flight.
49	28		T	66. In medal play if you hit another player's ball on the putting green, there is a penalty of two strokes.
78	03	*	F	67. The shaft of a golf club is the handle.
75	32		T	68. If there is no one attending the pin and your ball strikes it, there is no penalty in match play.
37	—08	*	T	69. The sole of a golf club is commonly known as the flange.
54	20		F	70. There is one stroke penalty in medal play for smoothing the ground in the line of your putt.
87	54		F	71. The toe of a golf club is commonly known as the heel.
79	40		F	72. In medal play if the pin is unattended and you hit it from more than 20 yards away, there is a two stroke penalty.
88	30		T	73. Any forward motion of the club head made with the intent of striking the ball is a stroke.
100	0	*	T	74. A ball is deemed to have moved if it leaves its position and comes to rest in another place.
96	49	*	F	75. The preliminary action of moving the wrists is called the swing.
83	70		F	76. Service roads on a golf course are considered hazards.
63	34		F	77. The No. 5 iron is called the niblick.
70	37		F	78. A "Rub of the Green" occurs when a ball in motion is stopped by a tree or bush.
86	32		T	79. Whenever two players have the same number of strokes on a hole, it is considered a halved hole.
85	40		T	80. When you top the ball and knock it off the tee, it counts as a stroke and it must be played where it lies.
87	30		T	81. Whenever a person hits beyond his normal swing, it is called pressing.
92	30		F	82. When looking for a lost ball, players should not allow following players to play through.
93	30		T	83. A singles match in golf is one in which one player opposes another, each playing his own ball.
26	28		F	84. A player is entitled to the whole tee when making a shot.
89	09		T	85. When you swing and miss the ball in golf, it is called a whiff.
97	35	*	T	86. The location of a player's feet when addressing the ball is called the stance.
84	13	*	T	87. When the results of a hole have been reported, players should immediately leave the green.

Difficulty Rating[1]	Index of Discrimination[2]	Need Revision	Answer	No.
93	35		T	88. A golf tee is a peg on which the ball is elevated.
74	44		F	89. It is legal to start playing on the third or fourth hole without going to the clubhouse first.
30	64		F	90. The maximum distance for a 5 par hole is 495 yards.
87	0	*	T	91. A player should always take the trouble to help his opponent look for a lost ball.
86	43		F	92. The shank of a golf club is that part which joins the toe of the club.
95	43	*	T	93. When a player is making a stroke, no one should move or make sounds such as talking or coughing.
64	47		F	94. Nassau is a system of scoring where one point is given for each nine and two points for the match.
96	49	*	T	95. Golf divots should be replaced even though you are in a hurry.
82	39		F	96. The plug of a golf club is located near the heel of the club.
84	23		T	97. On bright days players and caddies should stand so their shadows will not be in the line of play.
23	−13	*	T	98. The cleek is a No. 5 wood.
50	15		T	99. A single player has no priority in playing through.
89	53		T	100. The player farthest from the hole should always be allowed to play first.

[1]The lower the rating the more difficult the question.
[2]The higher the index the more discriminatory the question.

(Submitted 12-5-52)

Relationship of Physical Fitness to Success in College and to Personality

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THE PURPOSES OF this study[1] are to investigate (1) the relationship between physical fitness as measured by the Iowa Physical Efficiency Profile and success in school as measured by academic grades at the State University of Iowa and (2) the relationship between physical fitness and personality as measured by the Minnesota Multiphasic Personality Inventory.

Procedure

The subjects used in this study were 246 male Freshmen who were required to take physical education at the State University of Iowa at the beginning of the school year in September 1950.

The physical fitness of each subject was measured during the first week of school in September 1950 by the Physical Efficiency Profile as given by the Department of Physical Education for Men, State University of Iowa. This measuring instrument consists of four activities. They are:

1. Sit-ups for two minutes
2. Pull-ups
3. 100-yard pick-a-back run
4. 300-yard shuttle run

The score of each activity for every subject was recorded on a Physical Efficiency Profile card, and from these scores an average physical-fitness score was derived.

The Freshmen were not allowed to practice any of the four activities prior to the testing program. Every attempt was made to encourage the men to do their very best at all times in every activity.

The academic success of each subject was based upon the subject's grades during his Freshman year (1950-51) at the State University of Iowa. Academic success was denoted by the grade-point average earned during the Freshman year.

Along with the grade-point averages, the relationship of the written entrance examinations to physical fitness was also studied. These written examinations are given by the State University of Iowa to all Freshmen entering the College of Liberal Arts and provide seven separate measures of achievement. These are:

1. English placement
2. Reading comprehension

[1]This study was submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Division of Physical Education, Graduate College of the State University of Iowa, Iowa City, 1952.

3. Basic skills in mathematics
4. Reading rate
5. Composite score on Tests 1 to 4, inclusive
6. Theme writing
7. Speech.

The measuring instrument for personality in this study was the Minnesota Multiphasic Personality Inventory (3). It is a psychometric instrument designed to provide, in a single test, scores on all the more important phases of personality. These are:

1. Hypochondriasis scale
2. Depression scale
3. Hysteria scale
4. Psychopathic deviate scale
5. Interest scale
6. Paranoia scale
7. Psychasthenia scale
8. Schizophrenia scale
9. Hypomania scale

Analysis of Data

PHYSICAL FITNESS AND ACADEMIC SUCCESS

The physical fitness scores of 246 male Freshmen at entrance were correlated with their grade-point averages for the year. The result of the correlation was a coefficient of .41, which was significant at the one-per-cent level (4).

The physical-fitness scores at entrance of these same men were then correlated with the scores of each of the seven tests comprising the entrance examination. The correlations were so low that it was assumed that, for the group examined in this study, there was no significant relationship between physical fitness and each of the seven tests of achievement in the entrance examination. The coefficients of correlation were:

English placement and physical fitness	—.06
Reading comprehension and physical fitness	—.02
Basic skills in mathematics and physical fitness	.08
Reading rate and physical fitness	—.09
Composite score and physical fitness	—.07
Theme writing and physical fitness	—.13
Speech and physical fitness	.01

A study was conducted by the State University of Iowa (8) in which the grade-point averages for the Freshman year and the composite scores of the entrance examinations were correlated. The result was a coefficient of correlation of .52. In the present study, the coefficient of correlation between the grade-point averages for the Freshman year and the composite scores of the entrance examinations for the 246 subjects was .51.

Since the coefficients of correlation of .51 between the composite scores of the entrance examination and the grade-point averages for the Freshman year and of .41 between the physical-fitness scores and the grade-point averages for the year were significant, it was felt that a combination of the physical-fitness scores and the composite examination scores would be more significant in

relation to the academic success of entering students in the University. Therefore, a coefficient of multiple correlation was computed in which physical fitness scores and the composite scores of the entrance examination were correlated with the grade-point averages for the Freshman year. This resulted in a significant coefficient of multiple correlation of .666.

The multiple regression equation from which to predict grade-point average for the year from the Iowa physical fitness score and the composite score of the entrance examination is as follows:

$$\text{G.P.A.} = .296\ (\text{physical fitness score}) + .024\ (\text{composite test score}) - 9.78$$

PHYSICAL FITNESS AND PERSONALITY

The physical-fitness scores of 246 male Freshmen were correlated with the scores for the nine measures of personality in the Minnesota Multiphasic Personality Inventory. The coefficients were so low that it was assumed that, for the group tested in this study, there was no significant degree of relationship between physical-fitness scores and personality scores as measured by the Minnesota Multiphasic Personality Inventory.

It should be noted that all the coefficients of correlation were negative. A high score on the Physical Efficiency Profile indicates good physical fitness, whereas a high score on the Minnesota Multiphasic Personality Inventory indicates undesirable personality traits. The coefficients of correlation were:

Hypochondriasis and physical fitness	−.14
Depression and physical fitness	−.07
Hysteria and physical fitness	−.05
Psychopathic and physical fitness	−.06
Interest and physical fitness	−.16
Paranoia and physical fitness	−.01
Psychasthenia and physical fitness	−.04
Schizophrenia and physical fitness	−.07
Hypomania and physical fitness	−.03

The raw scores for each measure of personality in the Minnesota Multiphasic Personality Inventory were added together, and the total personality scores were correlated with physical-fitness scores. The result was a negative coefficient of correlation of .04, which has no statistical significance.

From these results, it can be definitely said that there is no statistically significant relationship between physical-fitness as measured by the Physical Efficiency Profile and personality as measured by the Minnesota Multiphasic Personality Inventory for the group of subjects used in this study.

Summary and Conclusions

1. There was a significant relationship between physical-fitness scores and grade-point averages for a year. The coefficient of correlation was .41, which is at the one-per-cent level of significance. This finding indicates that good physical fitness, as measured, tended to accompany, fairly well, achievement of academic success during the year for the subjects studied. It is possible

that physical fitness should be given consideration when one attempts to predict academic success for entering male Freshmen.

2. There was a significant relationship between composite scores of the entrance examinations and grade-point averages for a year. The coefficient of correlation was .51. This finding indicates that the composite test score, in this study, was associated with achievement of academic success during the Freshman year. It can also be assumed that composite test scores should be given consideration when one attempts to predict academic success for entering male Freshmen.

3. There was coefficient of multiple correlation of .666 between physical fitness scores and the composite test scores of the entrance examinations in relation to the grade-point averages for the year. This coefficient of multiple correlation permits the assumption that a knowledge of physical fitness (as measured) and of composite test score of the entrance examination might have some value in contributing to a prediction of how well an entering student might succeed scholastically during his Freshman year at the State University of Iowa.

4. There was no significant relationship, in this study, between the scores of the seven tests of achievement as measured in the entrance examinations and the physical fitness scores.

5. There was no significant relationship in this study between the physical-fitness scores and the scores in the nine measures of personality in the Minnesota Multiphasic Personality Inventory. According to the results obtained from the subjects used in this study, the physically fit have no more stable traits of personality than do the physically unfit.

6. There was no significant relationship between physical-fitness scores and total Minnesota Multiphasic Personality Inventory scores. The coefficient of correlation was a negative .04.

REFERENCES

1. Appleton, Lloyd O. The relationship between physical ability and success at the United States Military Academy. Doctor's dissertation, New York University, 1949.
2. Carter, G. C., and J. R. Shannon. Adjustment and personality traits of athletes and non-athletes. *School Review*, **48**: 127-130, 1940.
3. Hathaway, Starke R., and J. Charnley McKinley. *Manual for the Minnesota Multiphasic Personality Inventory*. New York: The Psychological Corporation, 1943.
4. Lindquist, E. F. *A First Course in Statistics*. New York: Houghton Mifflin Co., 1942. p. 195.
5. McCloy, Charles H. *Tests and Measurements in Health and Physical Education*. New York: F. S. Crofts and Co., 1942, p. 66.
6. Ray, Howard C. Interrelationship of physical and mental abilities and achievements of high school boys. *Research Quarterly* **11**: 141, 1940.
7. Sperling, Abraham P. The relationship between personality adjustment and achievement in physical education activities. *Research Quarterly* **13**: 351, 1942.
8. State University of Iowa. A study of the academic success of Freshmen and transfer students entering the College of Liberal Arts of the State University of Iowa, September, 1950. Office of the Registrar, Feb. 1952.
9. Westendarp, Dorothy E. Mental capacity and its relation to physical efficiency. *American Physical Education Review*, **28**: 216-219, 1923.

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Effects of Posture and Muscular Exercise on the Electrocardiogram

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THE ELECTROCARDIOGRAM (ECG) is a graphical record of certain electro-physiological phenomena occurring in the heart during a cardiac cycle. The electrocardiograph is the instrument used to record these changes. Medical authorities are not in complete agreement as to the value of the electrocardiograph as an instrument for measuring the functional efficiency of the heart.

Katz (14) has stated that there is nothing in the electrocardiogram which gives information concerning the power of the heart, the vigor of its contraction or its tone. He continues to say that only the presence or absence of injury currents, the character of the spread of the excitation, and its point of origin can be derived from the electrocardiogram. Von Csinady (24) states there is no relationship between the height of the T-wave and physical performance although no correlations between these two variables are given.

On the other hand, Dawson (8) believes it is legitimate to assume that a large resting T-wave means a forcible contraction, the opposite frequently appearing in heart disease. Broustet and Eggenberger (3), without making a claim that the R- and T-waves are affected by the vigor of the heart, still hold that there is a relationship between the form of the tracing and the anatomical and functional state of the heart. Cureton (7) has indicated that the use of the electrocardiogram to measure the functional efficiency of the heart has not been fully explored. Further study of the electrocardiograph as a device for indicating the adequacy of the heart's response to postural and exercise changes would seem to be warranted.

The purpose of this investigation[1] was to determine whether or not the electrocardiograph may be used as an instrument to record and differentiate variations in the physical condition of undiseased subjects, with tracings taken before and after mild, fairly active, and vigorous exercise.

Related Literature

Hoogerwerf (12) in a study of 260 Olympic competitors in the 1928 games at Amsterdam found that the P-wave increased after moderate exercise. Hoogerwerf noted that the tracings secured from participants after the marathon run showed a decrease in the amplitude of the P-, R-, S-, and T-waves. He

[1]The data were secured in the Physical Fitness Laboratory, School of Physical Education, University of Illinois. This study is a part of a Doctoral dissertation which was completed in August 1950.

stated that this decrease is a sign of fatigue and is due in all probability to a decrease in the strength of the ventricular contraction.

Kostjukow and Rieselman (15) examined weight lifters before and after exercise and found a significant increase in the amplitudes of the P- and T-wave for the trained group compared to a decrease in amplitude for the untrained group. They state that these waves are an indication of the functional condition of the strength of the heart. Paterson and Paterson (20) made an interesting roentgenogram and electrocardiographic study in Toronto of a walking marathon race (distance 31 miles) of ten subjects who completed the race. Roentgenograms were taken before and after the race (within ten minutes). ECG's were made before, immediately after, and two hours after the race. Although P- and T-waves increased in all cases, the differences were insignificant. They also found no correlation between decrease in heart size and the athletic ability of the participants.

Cooper, O'Sullivan, and Hughes (5) examined college oarsmen before and after strenuous rowing for one mile and also after a hard game of squash. In each case, all waves increased in amplitude in these highly trained subjects. Butterworth and Poindexter (4) gave an account of the ECG results of 35 boys, ages 16 to 24, engaged in the New York Daily News boxing tournament. Statistically significant changes were found in the increased height of the P-wave in Lead II taken after exercise. The R-wave showed an increase in all leads except Lead I, S-wave increased in Leads I and IV and decreased in Lead III, and the T-wave increased in the standard leads with a slight decrease in the precordial leads. They concluded from this study that boxing does not have any traumatic effect on the normal heart in this age group.

Most authorities (13, 16, 10) agree that a shift in posture (body position) with the "head-down" results in a decrease in the amplitude of the P-wave, while a shift in posture to a "head-up" position results in an increase in P-wave amplitude. Other studies (9, 23, 13, 17, 11, 26, 16, 19) have indicated that a shift in body position to an upright position usually results in an increase in pulse frequency with a decrease in R-wave and T-wave amplitude and an increase in S-wave amplitude.

To summarize, there seems to be a consensus on the following:

1. Amplitude measures increase with moderate exercise but decrease in the more exhaustive type of running event such as the marathon run.

2. These measures appear to increase more after moderate exercise in the trained than the untrained subjects.

3. Postural changes seem to be inversely related to pulse rate. In the "head-down" position, pulse rate slows, amplitude measures increase; conversely, in the "head-up" position, pulse rate increases, amplitude measures decrease.

4. Evidence is presented that when the waves of all three standard leads lessen in amplitude, the decrease is due to a gradual loss in strength of the heart muscle as reflected by a decrease in potential.

Procedure

The subjects in the study were divided into two groups. The *first group* (untrained), consisted of 102 individuals (ages seventeen to twenty-six). The *second group* (trained), consisted of 12 members of the University of Illinois Cross-Country Track Team. Paul Phinney, an excellent long-distance runner, was also tested as a part of the experiment.

The *first group* of subjects comprised a sampling of one hundred and two individuals, volunteers, from selected physical education classes at the University of Illinois. The selection of physical education classes was based on an attempt to get as wide a range of normal men as possible in various stages of physical condition.

TABLE 1

Mean Physique and Exercise Measurements of the Three "Condition Groups"

Group	Age (*Yrs.-Mo.*)	Height (*Inches*)	Weight (*Lb.*)	Type[1]	"All-Out" Run Time (*Mins.*)
Poor Condition	19-5	70.3	170.7	444	3.08
Average Condition	19-8	70.4	160.3	344	5.50
Good Condition	20-1	70.7	162.0	344	9.22
Average	19-8	70.5	164.3	3½44	5.93

[1]W. H. Sheldon, et al., *The Varieties of Human Physique*, New York: Harper and Brothers, 1940, p. 118.

The averages indicate that the sampling with reference to height, weight, and body type are slightly above the averages shown in the tables, in Cureton's (6) *Physical Fitness Workbook*, on college men. The "poor," "average," and "good" condition classification is based on performance times on an "All-Out" treadmill run at 7 mi./hr. up an 8.6-percent grade. The 34 subjects running for the shortest periods of time were placed in the "poor" condition group, the next 34 subjects in the "average" condition group, the 34 subjects running for the longest time were placed in the "good" condition group. A basic assumption in this study was that "All-Out" treadmill run time was indicative of the cardiovascular condition of the subject and would be reflected in the recovery pattern as recorded by the electrocardiograph.

Standardized directions in regard to eating habits, sleep, and exercise were given to each subject. Explanation was made as to the purpose of the test, the amount of time and effort required, and the personal benefits which might be derived.

The instrument used was the Sanborn "direct writing" Viso-Cardiette Model 51. This instrument meets the electrocardiograph requirements as set up by the American Medical Association (2). Standard leads were recorded in accordance with instructions listed in the Viso-Cardiette Instruction Booklet (21). Precordial leads were recorded in accord with the recommendation of the Standardization Committee of the American Heart Association (1).

Two precordial leads were used: Lead IV, taken in a diagonal through the nipple line at sternal position; and Lead V, taken in a diagonal through the nipple line at the fifth intercostal space. Body marking pencil was used to make sure the electrodes were placed in the same location for the before and after exercise tracings.

The *first group* testing procedure was as follows:

PRE-TRAINING PERIOD

Tracing	*Exercise and Position*	*When Taken*
(1)	Rested Lying ECG.	Subject rested a minimum of 5 minutes.
(2)	Rested Lying ECG (for reliability).	
(3)	Sitting ECG.	Immediately.
(4)	Standing ECG.	Immediately.
(5)	Standard Treadmill Run (4 min./5 mi./hr., 8.6% grade).	Taken 1 to 3 minutes after in lying position (standard lead electrodes left on during the run).
(6)	Standard Treadmill Run (for reliability). (4 min./5 mi./hr., 8.6% grade).	Taken 1 to 3 minutes after in lying position (standard lead electrodes left on during the run).

Practice Treadmill Run at 7 mi./hr.

POST-TRAINING PERIOD

Tracing	*Exercise and Position*	*When Taken*
(7)	Rested Lying ECG.	Subject rested a minimum of 5 minutes.
(8)	"All-Out" Treadmill Run 7 mi./hr., 8.6% grade.	Taken 3-5 minutes after in lying position.
(9)	"All-Out" Treadmill Run 7 mi./hr., 8.6% grade.	Taken 20-22 minutes after in lying position.

The criteria employed in this study included pre-exercise lying ECG tracing (Tracing 1) for the pre-training period and the equivalent tracing (Tracing 7) for the post-training period. Subjects reported for the two periods during the same week at least two days apart.

The *second group*, University of Illinois Cross-Country Track Team, was tested at the beginning (Nov. 1), the middle (Dec. 15), and the end (Feb. 1) of the training season. The squad consisted of twelve men, training daily for fourteen weeks (including several meets) during the fall semester. The opportunity to test this group was in conjunction with an ultra-violet light study by Miller (18). The testing procedure was as follows:

Tracing	*Exercise and Position*	*When Taken*
(1)	Rested Lying ECG.	Subject rested a minimum of 5 minutes.
(2)	"All-Out" Treadmill Run 10 mi./hr., 8.6% grade.	Taken 3 to 5 minutes after in a lying position.
(3)	"All-Out" Treadmill Run 10 mi./hr., 8.6% grade.	Taken 20-22 minutes after in a lying position.

One individual, Paul Phinney, a former varsity cross-country and track letterman, was also tested to observe the consistency of performance and test results by participation in seven different exercise tolerance tests, each performed twice. Phinney worked out daily with the cross-country track team. The schedule of testing follows:

Test Number	*Exercise*
1 & 2	Postural change, lying to standing.
3 & 4	1 Mile Run.
5 & 6	4.2 Mile Run.
7 & 8	7.9 Mile Run.
9 & 10	12 Mile Run.
11 & 12	"All-Out" Treadmill Run 10 mi./hr., 8.6% grade.
13 & 13	"All-Out" Treadmill Run 13.6 mi./hr., 8.6% grade.

Tracings were taken at the following time intervals:

Tracing	*Time Interval*
(1)	Rested Lying ECG (subject rested a minimum of 5 minutes).
(2)	3-5 minutes after exercise.
(3)	20-22 minutes after exercise.
(4)	40-42 minutes after exercise.
(5)	60-62 minutes after exercise.
(6)	80-82 minutes after exercise.
(7)	100-102 minutes after exercise.
(8)	16 hours after.

Subjects ran on a motor driven treadmill up an 8.6% grade in the University of Illinois Physical Fitness laboratory, Huff Gymnasium. Adequate warm-up was permitted and recommended before participation in the treadmill running. Every effort was made to motivate the subjects to definitely run "all-out" on the final test. They were told that the data could not be used for further analysis unless they could make this a "real" effort.

All ECG measurements were taken in accordance with those recommended by Sigler (22) and Wolf (25). Figures I and II show a typical ECG tracing lettered and marked according to standard procedure.

The "all-out" treadmill run time at 7 mi./hr., 8.6% grade distributed as follows in the *first group:*

TABLE 2

"All-Out" Treadmill Performance, 7 M.P.H., 8.6% Grade

Run Time (Minutes)	*f*	*Run Time (Minutes)*	*f*
16	1	6	23
14	2	4	24
12	1	2	28
10	7	0	3
8	13	Total	102

Subjects were placed in the poor, average, and good classification on the basis of their "all-out" treadmill run times. It may be observed that there is

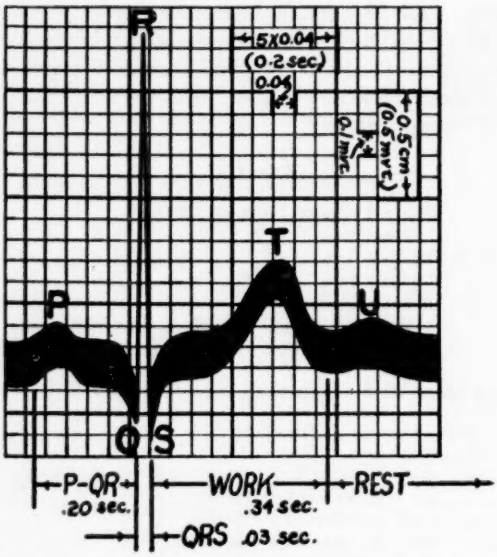

FIG. I. [1]Drawing of Actual Electrocardiogram Enlarged About Five Times.

Each single square of the graph represents 1 mm. Each group of 5 mm. is marked off in the horizontal and vertical by thicker lines. Measured in the horizontal, each millimeter represents a time interval of 0.04 second, therefore 5 mm. equals 0.2 second. Measured in the vertical, each mm. represents 0.1 mv. of current, if we employ the usual standardization, 1 cm. of deflection = 1 mv. of current. Hence, 5 mm. or 0.5 cm. of deflection equals 0.5 mv. of current. The duration of the P-wave, P-QR interval, QRS time, Work, and Rest respectively, for this normal electrocardiogram, are shown in the corresponding sections of the tracing.

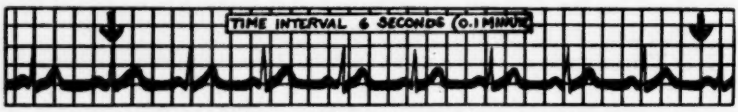

FIG. II. [1]Calculation of Auricular and Ventricular Rates.

Count 30 thick vertical lines, as shown between the two arrows, beginning with a line that falls directly on a wave. The time interval represented by this space is 30 × 0.2 second, or 6 seconds, which equals 0.1 minute. Multiplying the number of waves in this space by 10 gives the rate per minute. The number of ventricular waves here is 7.7. The rate is therefore 77 per min. Inasmuch as the auricular and ventricular waves are in normal sequence, the auricular rate is also 77 per min.

a definite skewness towards the lower run times. The range of the total group was 1.48 to 16.13 minutes, with a mean of 5.93 for the 102 subjects.

Results

Statistical analysis of the group results included the use of the product-

[1]From Sigler, L. H., *The Electrocardiogram, Its Interpretation and Clinical Application*, New York: Grune and Stratton, 1944.

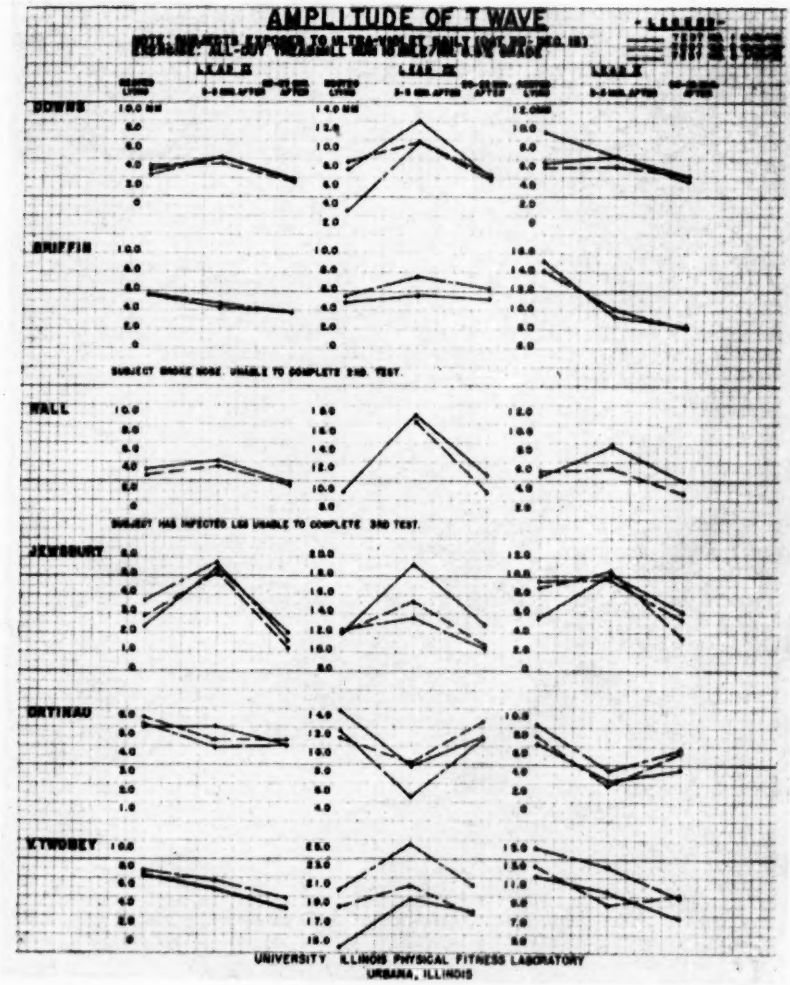

Chart 1. Amplitude of T-Wave.

moment correlation, critical ratio, and correlation ratio formulas. Reliability coefficients were obtained on the tracings for 25 subjects by correlating tracings taken on separate days under resting conditions. Reliabilities for standard exercise treadmill performance were also obtained. Coefficients of correlation ranged from .55 to .99 with 82% (37 out of 45) above .85. The range of correlations for the rested (.55 to .99) and standard exercise (.59 to .99) tracings was nearly equivalent for the three leads (II, IV, V).

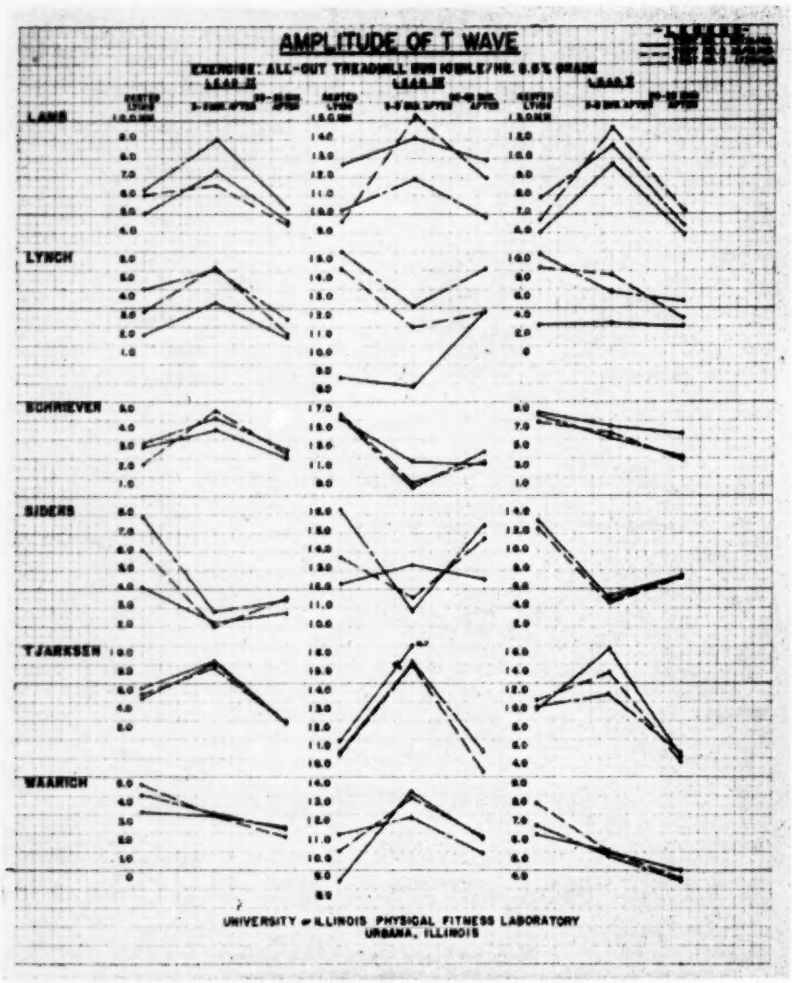

Chart 2. Amplitude of T-Wave.

The large sample "T" (Critical Ratio) test was used on the *first group* to show a comparison of exercise tolerance test results as recorded by the electrocardiograph. For convenience the findings are presented according to alterations in the individual waves of the ECG tracing and may be summarized for the total group (N=102) as follows:

1. *Amplitude of the P-wave.* The amplitude of the P-wave increased significantly as a result of postural changes and following both standard and

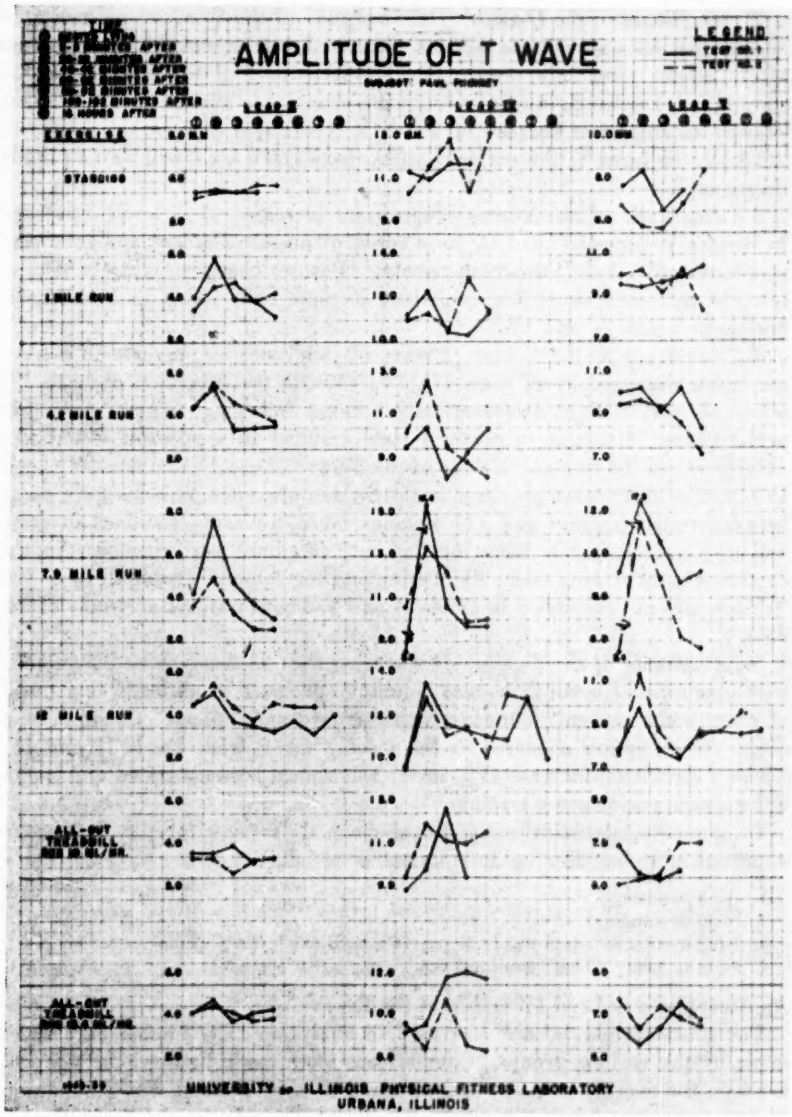

Chart 3. Amplitude of T-Wave.

"all-out" treadmill runs. This is indicated by the fact that the differences in means under the above conditions were significant at the one-per-cent level. The changes were greater after treadmill running than after posture changes.

2. *Amplitude of the Q-wave.* The amplitude of the Q-wave was measured and comparisons were made between the rested tracing and the tracing taken after "all-out" treadmill performance. Nearly half of the subjects (102) showed an amplitude increase following exercise while an equal number showed an amplitude decrease in Lead II. There was little or no change in Lead IV. In Lead V, the majority of subjects (68%) showed an amplitude decrease.

3. *Amplitude of the R-wave.* Significant increases (1% level) appeared in R-wave amplitude (Lead II) as a result of posture changes and following standard and "all-out" treadmill running. Posture changes (lying to sitting, lying to standing) showed a significant decrease (5% level) in R-wave amplitude in Leads IV and V.

4. *Amplitude of the S-wave.* Under all conditions an increase in S-wave amplitude appeared in all leads (II, IV, V) with the exception of Lead IV, which showed a slight decrease 20-22 minutes following "all-out" treadmill performance. Changes in postural state resulted in significant differences (1% level) in the mean amplitude of the S-wave (Lead IV). Likewise (Lead IV), similar differences appeared in the S-wave when comparisons were made between rested tracings and (1) tracings taken following standard exercise and (2) tracings taken following "all-out" treadmill performance. An exception was the tracing taken 20-22 minutes after "all-out" treadmill run. The "T" test was not calculated in Leads II and V due to positive skewness of the data.

5. *Amplitude of the T-wave.* This tracing showed the greatest consistency with a significant mean difference amplitude decrease in all leads as a result of posture changes and following both standard and "all-out" treadmill running. An exception appeared in the tracing taken from Leads II and IV, where a significant increase (1% level) was shown between rested and standard exercise performance tracing.

In summary, statistically significant mean differences for the *first group* appeared in almost all amplitude measures as follows:

1. lying to sitting.
2. lying to standing.
3. lying to after standard treadmill run (4 min./5 m.p.h./8.6% grade).
4. lying to after "all-out" treadmill run (7 m.p.h./8.6% grade).

An exception was Lead IV and V of the R-wave.

The small sample "t" test was used in analyzing ECG tracing differences made by the various groups. Comparisons were made between the good to average, the average to poor, and the good to poor groups. The assumption of equal variance between groups was met by the calculation of the F-ratio test. ECG variations that occur between groups seem to indicate that it may be possible to differentiate between *good* ($N=34$) *and poor* ($N=34$) condition groups (Tables 3 and 4) on the basis of ECG tracing changes that occur with shifts in posture and following running exercise performance. The findings are as follows:

TABLE 3

Comparisons of Groups with Respect to Exercise Tolerance Test Gains as Recorded by the Electrocardiograph

Groups Compared	Mean Differences		Difference in Means	t	$t_{0.05}$	$t_{0.01}$
	Good Condition	Poor Condition				
Amplitude of P-wave (Lead II)						
1 vs. 3 (AC)	.20	.17	.03	0.429	1.998	2.652
1 vs. 4 (AC)	.44	.33	.11	0.367	1.998	2.652
1 vs. 5 (AC)	.63	.41	.21	0.568	1.998	2.652
7 vs. 8 (AC)	.43	.12	.31	2.583	1.998	2.652
7 vs. 9 (AC)	.49	.36	.13	1.444	1.998	2.652
(Lead IV)						
1 vs. 3 (AC)	.10	.00	.10	1.667	1.998	2.652
1 vs. 4 (AC)	.19	.11	.08	0.103	*2.034	*2.733
1 vs. 5 (AC)	.17	— .06	.23	0.767	*2.034	*2.733
7 vs. 8 (AC)	.06	.02	.04	0.123	1.998	2.653
7 vs. 9 (AC)	.13	.27	.14	1.667	1.998	2.652
(Lead V)						
1 vs. 3 (AC)	.17	.11	.08	1.333	*2.034	*2.733
1 vs. 4 (AC)	.34	.26	.08	1.230	1.998	2.652
1 vs. 5 (AC)	.36	.05	.31	1.148	1.998	2.652
7 vs. 8 (AC)	.22	— .02	.24	2.105	1.998	2.652
7 vs. 9 (AC)	.30	.23	.07	1.000	*2.034	*2.733
Amplitude of R-wave (Lead II)						
1 vs. 3 (AC)	.95	— .26	1.21	3.134	*2.039	*2.733
1 vs. 4 (AC)	.65	— .14	.79	1.965	*2.034	2.652
1 vs. 5 (AC)	.30	1.01	.71	1.778	1.998	2.652
7 vs. 8 (AC)	.76	.96	.20	0.465	1.998	*2.733
7 vs. 9 (AC)	.08	.34	.26	0.662	1.998	2.652
(Lead IV)						
1 vs. 3 (AC)	— .40	— .13	.27	0.730	*2.034	*2.733
1 vs. 4 (AC)	.09	— .48	.57	1.247	1.998	2.652
1 vs. 5 (AC)	.31	.09	.22	0.626	1.998	2.652
7 vs. 8 (AC)	— .01	.24	.25	0.023	*2.034	*2.733
7 vs. 9 (AC)	.41	.42	.01	1.044	1.998	2.652
(Lead V)						
1 vs. 3 (AC)	— .04	— .98	.94	1.916	*2.034	*2.733
1 vs. 4 (AC)	— .51	—2.33	1.82	0.779	*2.034	*2.733
1 vs. 5 (AC)	.01	.75	.74	2.403	1.998	2.652
7 vs. 8 (AC)	—1.65	.46	2.17	0.617	1.998	2.657
7 vs. 9 (AC)	—3.06	—2.50	.56	1.930	1.998	2.655

TABLE 4

Comparison of Groups with Respect to Exercise Tolerance Test Gains as Recorded by the Electrocardiograph

Groups Compared	Mean Differences		Difference in Means	t	$t_{0.05}$	$t_{0.01}$
	Good Condition	Poor Condition				
Amplitude of S-Wave (Lead II)						
1 vs. 3 (AC)	.24	.13	.11	0.973	1.998	2.652
1 vs. 4 (AC)	.21	.10	.11	0.714	1.998	2.652
1 vs. 5 (AC)	1.30	1.10	.20	0.727	1.998	2.652
7 vs. 8 (AC)	1.06	1.00	.06	0.240	1.998	2.652
7 vs. 9 (AC)	.13	.23	.10	0.625	1.998	2.652
(Lead IV)						
1 vs. 3 (AC)	.69	1.06	.37	0.530	1.998	2.652
1 vs. 4 (AC)	3.39	3.09	.30	0.364	1.998	2.652
1 vs. 5 (AC)	2.19	1.23	.96	1.424	1.998	2.652
7 vs. 8 (AC)	2.67	2.70	.03	0.040	1.998	2.652
7 vs. 9 (AC)	— .20	— .40	.20	0.242	*2.034	*2.733
(Lead V)						
1 vs. 3 (AC)	.68	1.22	.54	1.256	*2.034	*2.733
1 vs. 4 (AC)	1.91	2.88	.97	1.617	*2.034	*2.733
1 vs. 5 (AC)	1.94	1.86	.08	0.136	*2.034	*2.733
7 vs. 8 (AC)	2.67	2.28	.39	1.037	1.998	2.653
7 vs. 9 (AC)	.91	.44	.47	1.572	1.998	2.652
Amplitude of T-Wave (Lead II)						
1 vs. 3 (AC)	—1.09	—1.11	.02	0.095	1.998	2.652
1 vs. 4 (AC)	—1.74	—1.63	.11	0.478	1.998	2.652
1 vs. 5 (AC)	1.42	.65	.77	1.673	*2.034	*2.733
7 vs. 8 (AC)	— .62	— .50	.12	0.358	*2.034	*2.733
7 vs. 9 (AC)	—1.21	—1.19	.02	0.096	1.998	2.652
(Lead IV)						
1 vs. 3 (AC)	.60	— .29	.89	2.730	*2.034	*2.733
1 vs. 4 (AC)	.59	—1.14	1.73	3.931	*2.034	*2.733
1 vs. 5 (AC)	2.69	3.22	.53	0.679	1.998	2.652
7 vs. 8 (AC)	—1.67	— .13	1.54	2.138	1.998	2.653
7 vs. 9 (AC)	—1.25	— .89	.36	0.800	1.998	2.652
(Lead V)						
1 vs. 3 (AC)	—1.02	—1.48	.46	1.243	1.998	2.652
1 vs. 4 (AC)	—2.44	—3.05	.61	1.356	1.998	2.652
1 vs. 5 (AC)	.20	— .05	.25	0.373	1.998	2.652
7 vs. 8 (AC)	—2.56	—2.60	.04	0.072	*2.036	*2.736
7 vs. 9 (AC)	—2.49	—2.73	.24	0.558	1.998	2.652

Notes for Table 3

NOTE: A = Good Condition group differences C = Poor Condition Group differences
1 = Rested Lying ECG 3 = Sitting 4 = Standing
5 = Lying 1 to 3 minutes after 4 min./5 m.p.h. Treadmill Run 8.6% grade
7 = Rested Lying ECG 8 = Lying 3 to 5 minutes after "All-Out" Treadmill Run, 7 m.p.h. 8.6% grade
9 = Lying 20 to 22 minutes after "All-Out" Treadmill Run, 7 m.p.h. 8.6% grade
*Substitute "t" test used from A. L. Edwards, *Statistical Analysis for Students in Psychology and Education*, p. 295 (New York: Rinehart & Company, Inc., 1946).

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9 = Lying 20 to 22 minutes after "All-Out" Treadmill Run, 7 m.p.h., 8.6% grade
*Substitute "t" test used from A. L. Edwards, *Statistical Analysis for Students in Psychology and Education*, p. 295 (New York: Rinehart & Company, Inc., 1946).

1. *Amplitude of the P-wave.* Statistically significant differences at the 5% level were found in Lead II and V, lying to 3-5 minutes after "all-out" treadmill run. Change from positive to negative means was observed in Lead II, lying to 1-3 minutes after standard exercise run; and Lead IV, lying to 3-5 minutes after "all-out" run.

2. *Amplitude of the R-wave.* Statistically significant at the 5% level in Lead II, lying to sitting; and in lead V, lying to 3-5 minutes after "all-out" treadmill run. Change in direction from positive to negative occurred in Lead II, lying to sitting to standing; and in Lead IV, lying to standing. Change from negative to positive in Lead IV and V, lying to 3-5 minutes after "all-out" run.

3. *Amplitude of the T-wave.* Significant differences at the 5% level in Lead IV, lying to sitting to standing; and in Lead IV, lying to 3-5 minutes after standard exercise run.

The *second group*, 12 members of the 1949-50 University of Illinois Cross-Country Track Team were tested in conjunction with a Master's thesis (18) on ultra-violet light. The subjects ran "all-out" on the treadmill at 10 m.p.h., 8.6% grade at each of three different stages of training. Treadmill run times distribution (N = 12):

Date	Range (Min. Sec.)	Mean (Min. Sec.)
Nov. 1	1'20"——5'20"	3'12"
Dec. 15	2'24"——4'36"	4'00"
Feb. 1	2'16"——4'24"	3'57"
	1'20" to 5'20"	3'43"

Graphical records of changes in the amplitude of the T-wave (Charts 1 and 2) are presented. The results of the tests demonstrate that during the course of 16 weeks of cross-country training in the fall, including several meets, the following ECG changes occurred in the before and 3-5 minutes after "all-out" treadmill run:

21 out of 34 (61.7%) increased the P_{II} wave
20 out of 31 (64.5%) decreased the P_{IV} wave
16 out of 30 (53.3%) decreased the P_{V} wave

33 out of 34 (97.1%) increased the R_{II} wave
21 out of 33 (63.6%) increased the R_{IV} wave
16 out of 31 (51.6%) increased the R_{V} wave

23 out of 25 (92.0%) increased the S_{II} wave
20 out of 34 (58.8%) increased the S_{IV} wave
33 out of 33 (100%) increased the S_{V} wave

20 out of 33 (61.1%) increased the T_{II} wave
22 out of 33 (66.6%) increased the T_{IV} wave
20 out of 32 (66.4%) increased the T_{V} wave

The consistency of performance and ECG test results on the three exhaustive runs were comparable to the *first group* responses.

Paul Phinney, an excellent long-distance runner, was tested twice on each of seven different exercise tolerance tests over a period of three months. He ran daily as a part of the cross-country group and was in good condition at the start of the testing period. The pattern of response, after runs of 1 mile, 4.2 miles, 7.9 miles, 12 miles, as well as in the "all-out" treadmill runs at 10 and 13.6 m.p.h., 8.6% grade, showed the P-wave decreased while the R, S, and T-waves increased in tracings taken 3-5 minutes after exercise. The changes induced were not proportional to the intensity or the duration of the exercise. Graphical records of changes occurred in the *amplitude of the T-wave* (Chart 3) are presented. The experiment on Phinney indicates that his heart withstood the long-distance running without obvious fatigue. This was evident by the recovery pattern shown in the ECG tracings.

Conclusions

The following conclusions seemed justified on the basis of the evidence presented:

1. The electrocardiograph can record the effects of exercise, and these results may be used to differentiate between good and poor cardiovascular condition.

2. Statistically significant differences with the group sample of one hundred and two subjects appeared in almost all amplitude measures as follows:

1. lying to sitting.
2. lying to standing.
3. lying to after standard treadmill run (4 min./5 m.p.h./8.6% grade).
4. lying to after "all-out" treadmill run (7 m.p.h./8.6% grade).

The exception was Lead IV and V of the R-wave. The P- and S-waves increased in all leads (II, IV, V) rested to tracings taken after moderate and rested to tracings taken after strenuous exercise in the untrained (first group) subject, while the T-wave decreased in all leads. The R-wave decreased in the same group (Leads IV and V) and increased in Lead II. There was a definite decrease in the RS-T segment displacement following "all-out" treadmill running 7 m.p.h./8.6% grade.

3. Trained (Cross-country team) subjects show an increase in P-wave amplitude in Lead II and a decrease in Lead IV and V after "all-out" treadmill running at 7 m.p.h./8.6% grade. The R and S-wave amplitudes show an increase with the same exercise in all leads (II, IV, V) with Lead II showing an increase of nearly 100% (97.1%) of the R-wave tracings taken. Amplitude of the T-wave shows an increase in all Leads (II, IV, V) following the "all-out" run. These changes in direction were comparisons between rested and exercise tracings.

4. Trained subjects show greater increases or greater decreases in the amplitude measured than the untrained subject in the same exercise. A difference in direction of the changes may also be noted. The P and S-waves increase and the R and T-waves decrease in the untrained subject following exercise. In contrast, with the trained subject the P-wave decreased while the R, S, and T-waves increased after exercise. The changes between the trained and untrained group although opposite in direction were approximately the same in magnitude.

5. Statistically significant differences at the 5% level occurred between good and poor condition groups in the amplitude of the P and T-wave after "all-out" treadmill running at 7 m.p.h./8.6% grade. Significant differences at the 5% level in the same condition groups also occur in changes from lying to sitting and lying to standing in the P, R, and T-wave amplitudes. The changes between these groups were an increase in P and S-wave amplitude and a decrease in R and T-wave amplitude. Changes in posture may suggest a valid method of dfferentiating between poor and good cardiovascular condition on the basis of ECG records taken before and after position change.

6. The Q-wave amplitude decreased in height after "all-out" treadmill run at 7 m.p.h./8.6% grade. This decrease appears the greatest (81.8% of the number of individuals showing change) in the good condition group.

7. The results, in general, are in accord with similar investigations reported in the related literature.

REFERENCES

1. American Heart Association. *The Standardization of Electrocardiographic Nomenclature* (2nd Supplemental Report). New York: American Heart Association, 1943.
2. American Medical Association Council. American Medical Association Councils List of Electrocardiographic Requirements, *Journal of the American Medical Association*, **134**: 455, May 31, 1947.
3. Broustet, P., and H. Eggenberger. Electrocardiogram of Athletes, *Journal de Medecines de Bordeaux et du Sud-Ouest*, **113**: 126-127, 1942.
4. Butterworth, J. S., and C. A. Poindexter. "An Electrocardiographic Study of the Effects of Boxing," *American Heart Journal*, **23**: 59-64, 1942.
5. Cooper, E. L., J. O'Sullivan, and E. Hughes. *Athletics and the Heart.* An Electrocardiographic and Radiological Study of the Response of the Healthy and Diseased Heart to Exercise, *Medical Journal of Australia*, **1**: 569-579, 1937.
6. Cureton, T. K. *Physical Fitness Workbook.* St. Louis: C. V. Mosby Co., 1947.
7. Cureton, T. K. *Physical Fitness Appraisal and Guidance.* St. Louis: C. V. Mosby Co., 1947.

8. Dawson, P. M. *The Physiology of Physical Education.* Baltimore: The Williams and Wilkins Co., 1935.
9. Enghoff, H. Über die Einwirkung Passiver Körperlageveränderungen auf die Pulsfrequenz und das Elektrokardiogramm, *Acta Scholae Medicinalis* (Kyoto), **52:** 177-209, 1919.
10. Green, R. S., A. Iglauer, and J. McGuire. Alterations of Radial or Brachial Intra-Arterial Blood Pressure and of the Electrocardiogram Induced by Tilting, *Journal of Laboratory and Clinical Medicine,* **33:** 951-961, Aug. 1948.
11. Hinrichs, A. Welche diagnostischen Erkenntnisse vermittelt der Vergleich des Elektrokardiogramms beim liegenden und stehenden Menschen? *Zeitschriff für Kreislaufforschung,* **29:** 790-97, 1937.
12. Hoogerwerf, S. Elektrokardiographische Untersuchungen der Amsterdamer Olympiadekampfer, *Arbeitsphysiologie,* **2:** 61-76, 1929.
13. Janzen, R. Die Änderungen des Elektrokardiogramms beim Übergang aus dem Liegen in die aufrechte Körperstellung, *Zeitschrift fur die Gesamte Experimentelle Medizin,* **103:** 671-693, 1938.
14. Jatz, L. N. *Electrocardiography.* Philadelphia: Lea and Febiger (2nd ed.), 1947.
15. Kostjukow, I. I., and S. D. Reiselman. Änderungen im Elektrokardiogramm nach Dosierter Korperlicher Arbeit, *Arbeitsphysiologie,* **3:** 415-448, 1930; **5:** 1-16, 1931.
16. Mayerson, H. S., and H. L. Wolf. Sympathetic Component of the Electrocardiogram Response to Posture, *American Heart Journal Abstracts,* **37:** 650, 1949.
17. Mayerson, H. S., and W. D. Davis, Jr. Influence of Posture on the ECG, *American Heart Journal,* **24:** 593-601, 1942.
18. Miller, L. W. *A Study of the Effects of Ultra-Violet Radiation on the Cardiovascular Fitness of Cross-Country Runners.* Unpublished Master's thesis, University of Illinois, 1950.
19. Newton, M. ECG Changes on Tilting, *Amerian Heart Journal,* **37:** 1090-1101, June 1941.
20. Paterson, R., and E. Paterson. An Experiment on the Efficiency of Exercise on the Heart of Athletes, *American Journal of Roentgenology,* **34:** 158-64, 1935.
21. Sanborn Viso-Cardiette Instruction Booklet. Cambridge: Sanborn Co., 1948.
22. Sigler, L. H. *The Electrocardiogram, Its Interpretation and Clinical Application.* New York: Grune and Stratton, 1944.
23. Stewart, H. J., and R. L. Bailey. Effect of Posture on the Form of Precordial Leads of the Electrocardiogram, *American Heart Journal,* **18:** 271-281, Sept., 1939.
24. Von Csinady, E. Sportzarztliche Untersuchungen III, Mitteilung: Vergleichende Elektrokardiographische Untersuchungen En Sporttreinenden bei besonderer, Berucksightugung der EKG-Zweitwerte, *Arbeitsphysiologie,* **3:** 579-595, 1930.
25. Wolf, J. G., *Electrocardiogram Standards for Normal Young Men.* Unpublished *Master's thesis,* University of Illinois, 1947.
26. Ylvisaker, L. S., and H. B. Kirkland. Significance of Position of Subject in Evaluation of the Electrocardiogram, *American Heart Journal,* **20:** 592-598, Nov. 1940.

(Submitted 7-15-52)

Research Abstracts

Prepared by the Research Abstracts Committee of the National Council of the Research Section, PAUL A. HUNSICKER, Chairman

Education

60. COREY, STEPHEN M. *Action Research To Improve School Practices.* New York: Bureau of Publications, Teachers College, Columbia University. 161 pp. 1953.

The author, in some general comments on research in education, points out that there is a considerable time-lag between the published results of a research project and the adoption of the findings by workers in the field. He further contends that the lag is not due to a lack of communication between the two groups. Generally speaking, it takes more than reading to change behavior!

One chapter is devoted to the "Action Research Process" but it is exceedingly difficult to differentiate this process from traditional research work. Action research is supposedly more flexible in regard to experimental design but the number of parallel requisites in each process far exceeds the number of differences. The person engaged in action research is more apt to be interested in applying the findings to a specific problem which currently confronts him. His counterpart, working in traditional research, is concerned with investigations which will enable him to make generalizations of the widest possible applicability. The differences are roughly analogous to those offered by physical scientists in their attempt to demarcate pure research from applied research.

Two action research studies are cited in some detail in order to substantiate the thesis that this type of research work can be of genuine, practical value to the teacher. It is obvious that the implications of action research are for in-service education.

A number of stimulating questions are raised regarding the value of statistics courses to students of education. The practical implications of statistics are often lost due to the unrealistic approach of the instructor.

The notes to the various chapters refer the reader to worthwhile collateral reading and these combined with the bibliography should serve as an excellent reading list for educators interested in improving their teaching. The author demonstrates, in a rather convincing manner, that teachers who may not have had experience with the relatively refined methods of traditional research can carry on action research.—*Paul Hunsicker.*

61. MAUL, RAY C. Are schools losing the "man" in their manpower? *School and Society,* **77**: 1, 369-372 (June 13, 1953).

An analysis of the 1952 and 1953 college graduates prepared to meet standard certification, by teaching field and by sex, was made. Other dominating factors operating in the current scene were scrutinized. The study indicated that not only were there fewer men percentagewise prepared to teach but several factors serve to deplete the ranks of those who would go into the classroom.—*D. B. Van Dalen.*

Health Education

62. EICHENLAUB, J. D. *Varicose veins, Today's Health,* **31**: 34-35, 50-52 (July 1953).

The veins have the responsibility of driving the used blood back to the heart and this continued "milking" activity is done with little effort as long as the individual is walking or running. However, standing slows this process to a stop, and leaves the pressure of a column of blood pushing on the thin vein walls. The deep veins, braced in all sides by muscle, stand this strain well, but the surface veins have nothing but soft, fat and elastic skin to brace them. After a time, they gradually stretch and enlarge. Surgery, (1) tying off the surface veins where they enter the bigger deep veins along with injections to enhance clothing or (2) the removal of surface veins, still is an argumentative procedure with many physicians. Temporary relief can be obtained by bandaging or the

simple exercise of shoe removal, lying on the back with feet up and rapid jiggling of the feet.—*J. Grove Wolf.*

63. FABRICANT, NOAH D. *What specialists know about sinusitis, Today's Health,* **31**: 20-21, 52-53 (April 1953).

The nasal sinuses are cavities in the skull communicating directly with the nose. There are eight sinuses, four on each side of the nose. Sinus disease begins during the late stages of the common cold, but may be evoked by allergy rather than infection. Treatment consists of rest, the application of heat, and the use of the proper nasal drug to enable the patient to breathe freely and to establish sinus drainage. Specialists now seem to agree not to operate unless all other methods of relief have been used.—*J. Grove Wolf.*

64. HATHAWAY, VICTORIA. Overweight?, *Today's Health,* **31**: 40-41, 67 (June 1953).

Experiments in the Department of Endocrinology and Metabolism at the University of Michigan show conclusively that overweight people do not utilize food in a better way than do lean or normal weight people. We get fat because we take in more food than we need and to blame our glands for this weight increase has little foundation. The endocrine glands may influence body weight, but this is not the usual case. The thyroid gland makes a person listless and the underfunctioning of the pituitary gland will influence the distribution of fat, but no evidence has been found at the University of Michigan that your glands will make you overweight. Many factors can indirectly influence your increase in weight, including your temperament, eating habits, social life and activity but basically, if you're fat, you're eating too much!—*J. Grove Wolf.*

65. HUMPHREY, BARBARA. Keep cool and live longer, *Today's Health,* **31**: 18-19, 60 (Aug. 1953).

Several studies have shown the effect of heat on work efficiency and longevity. Of the food taken into the body, approximately 10% goes into measurable physical work, while 90% is turned directly into heat. Research studies have shown that when healthy men walked on a treadmill under high temperatures, there was a marked rise in heart rate and body temperature and a drop in blood pressure. These subjects became dull and apathetic, had such symptoms as fatigue, headache, loss of appetite, heat cramps, vomiting, lack of co-ordination, and the like. Scientists recommend during hot weather to dress lightly, stay out of the sun, and avoid any unnecessary physical activity. They also recommend an increase in the consumption of fluids, to take extra salt, and to get plenty of sleep. It has been said that man is so hot he burns out quickly and that he could live for 500 years if his body temperature were 90.6 degrees instead of 98.6—*J. Grove Wolf.*

66. KAHN, L., AND G. BROWN. Wetzel grid analysis of rheumatic children. *J. Pediat.,* **41**: 47-53 (1952).

A comparison of the distribution on the Wetzel Grid of 157 children from 5 to 14 years at the initial episode of acute rheumatic fever with that of 3,366 normal grade-school children points to growth failure among rheumatic children. On a follow-up of these children, however, 93% demonstrated marked improvement in growth and development. The use of the Wetzel Grid in following the individual child with rheumatic fever is suggested.—*Psychological Abstracts.*

67. KENT, JOHN L. Research to save your teeth, *Today's Health,* **31**: 24-25, 58-61 (Sept. 1953).

The National Bureau of Standards' dental research laboratory is still pursuing its two original goals: finding what causes teeth to decay, and finding the ideal material for filling teeth. From 1928 to 1950 the American Dental Association contributed more than $650,000 to research at the Bureau of Standards. An official of the American Dental Association recently said 700 million fillings would be required to restore American mouths to healthy condition. Plastics may be used for front teeth because they can be made to look natural. However, they are not as strong as metal but do not dissolve as

much as tooth-colored silicate cements. NBS researchers feel that mixtures of acrylic and vinyl resins are the best materials for filling tooth cavities. The latest development to come from the dental research lab is a new technique, using the natural fluorescence of human teeth, to reveal up-to-now undetected details of tooth structure. NBS technicians have been able to obtain fluorescent photomicrographs from the visible light emitted by very thin tooth sections under high-intensity ultraviolet radiation.—*J. Grove Wolf.*

68. Stevenson, G. S. Your stake in mental health, *Today's Health*, **31**: 35, 50-53 (May 1953).

Statistics show that during one's lifetime one out of every 12 may be expected to be hospitalized for mental illness. Although about 30% of the admissions to hospitals are old people, most of them do not live long. Therefore, to claim the illnesses of old age are responsible for the overcrowding of our mental hospitals is simply an excuse for failure to make adequate provision for the mentally ill. Schizophrenia, formerly known as dementia praecox, accounts for more than one-half of the patients in our hospitals. The most common cause seems to be adverse living conditions with the result that the adrenal gland secretions are thrown off balance. Treatment with insulin, electrical stimulation, and surgery can be used more effectively with research continuing to make further progress on the cause, cure, and effect of mental disease.—*J. Grove Wolf.*

69. World Health Organization. Joint Expert Committee. Rehabilitation of the physically handicapped child. *Chron. World Health Org.* **6**: 329-331 (1952).

A prospectus of the forthcoming report (No. 58 in the World Health Organization: Technical Report Series) of the Joint Expert Committee's point of view and approach to problems of prevention of handicaps, physical rehabilitation and emotional adjustment, educational guidance and employment, and special disabilities. — *Psychological Abstracts.*

Recreation

70. National Recreation Association. Recreation salaries. *Recreation*, **46**: 4 (Sept. 1952).

A questionnaire was sent to 223 cities with well-developed recreation programs established on a year-round basis, selected to provide an adequate cross-section of public departments. Information was requested concerning salaries, cost of living adjustments, vacation and sick leave provisions, car allowances, and civil service status of recreation employees. The findings of the survey were based on an analysis of the 148 returns received.

Some findings of the study were as follows: (1) Recreation salaries ranged widely from $1,200 to $11,000; (2) In general, salaries increased with the size of the city; (3) Fewer staff positions and lower staff salaries existed in the cities of less than 50,000 population; (4) In only two positions did the actual maximum salary exceed the recommended range, and in both cases this salary was reported for only one department; (5) The lowest salaries reported were, with one exception, below the minimum suggested (Camp Director); (6) In all but two categories, more than half of the workers reported were receiving more than the minimum salary recommended for the position; (7) Over the period 1948-52, every position on the full-time recreation staff showed an increase in median salary; and (8) Listing the 13 major categories of position by rank, according to amount of increase for the median position in 1952 over the median position in 1948, showed that greatest cash increases went to special activity supervisors and to workers involved in direct leadership of recreation activities.—*Jackson M. Anderson.*

71. Smith, Billie F. How 40 camps handle rest hour, *Camping Magazine*, **24**: 9 (Dec. 1952).

The findings of the study were based on a survey of camp directors. Each director was asked to indicate the manner in which the rest hour was handled at his camp.

It would appear to be psychologically wise to call the rest hour anything but that and to keep in mind that it is a change of activity rather than a lack of activity. Suggested

names for this period included: (1) Siesta; (2) Half Time; and (3) FOB—Feet on Bed and Flat on Back. The length of the rest hour depended on many variable factors including the following: (1) weather and climate; (2) activeness of daily program; (3) evening plans; and (4) needs of the children involved. Many camps used just one hour after the noon meal. Others broke the time into half-hour periods before and after lunch. The time varied from 45 minutes in mild climates to two hours in very hot climates. Management of this hour also varied. Some camps had one or two counselors in an area, while many camps felt that each cabin counselor should rest with the campers as an example. The problem of management can be decreased, or even eliminated, with high-quality leadership, older counselors, and counselors who read aloud well. Some camps let camper councils or committees come to a general agreement as to fair and reasonable privileges and restrictions to use during the period.—*Jackson M. Anderson.*

72. National Recreation Association. Surfaces for multiple-use recreation areas, *Recreation,* **46:** 10 (March 1953).

A questionnaire was sent to park and recreation authorities, asking them to rate their multiple-use areas according to the degree to which they had proved excellent, satisfactory, fair, or poor for each of twelve recreation activities. The findings of the survey were based on an analysis of the 250 returns received.

Some findings of the study were as follows: (1) Analysis of the cases where multiple-use areas were rated "excellent" reveals that concrete far outranked asphalt in the percentage of cases receiving this rating; (2) Concrete areas were rated "excellent" for roller skating and shuffleboard by a majority of the authorities reporting; (3) Asphalt was used more widely and generally than concrete for multiple-use areas, judged by the number of areas on which reports were submitted; (4) Of all the ratings on concrete areas, 73% were "excellent" or "satisfactory"; (5) At least 75% of the ratings on both concrete and asphalt areas were "excellent" or "satisfactory" for basketball, handball, tennis, and volleyball; (6) Concrete areas did not receive a single "excellent" rating for softball and touch football, and did not receive a single "poor" rating for handball and tennis; (7) Basketball and volleyball, the most frequently reported activities, were played extensively and satisfactorily on multiple-use areas, with a slight preference for asphalt; and (8) Ice skating, not too frequently reported, was generally successful on concrete.—*Jackson M. Anderson.*

Tests and Measurements

73. Keislar, Evan R. Test instructions and scoring method in true-false tests, *Journal of Experimental Education,* **21:** 3, 243-249 (March 1953).

Two true-false examinations were administered to college students four weeks apart. For each examination, two sets of answers to each item were required. Instructions were given that the tests would be scored by number right and right minus wrong methods. Nothing was said about guessing. The results were so highly similar that it would make little difference which method were employed. No significant relationship was found between the number of omitted items and the test scores on either method.—*D. B. Van Dalen.*

74. Slater-Hammel, A. T. Visual Blackout in Athletics. *Athletic Journal,* XXXIII: 28, 47 (May 1953).

Involuntary blinking may be responsible for a variety of human errors ranging from automobile accidents to missed tennis balls. Dr. Lawson of the University of Sheffield concluded that this blackout interval ranges from .1 to .3 seconds. In baseball, a fast ball takes no longer than .4 to .6 seconds to travel from the pitcher to the catcher. If the batter blinks as the ball is pitched he would not see the ball for from 10 to 15 feet (blink duration .1 second) or from 30 to 45 feet (blink duration .3 second) of its flight. A study of blackout threshold at the University of Indiana (25 subjects) showed the times ranged from .04 to .09 seconds, median .07 seconds. This could well mean the difference between success and failure in athletic competition.—*J. Grove Wolf.*

OTHER AAHPER PUBLICATIONS

1. **Administrative Problems in Health Education, Physical Education, and Recreation.* 1953. 136 pp. Paper $2.00; Cloth $2.50

2. ***School Health Services.* Prepared by Joint Committee on Health Problems in Education of the NEA and AMA. 1953. 480 pp. $5.00

3. *Convention proceedings of the College of Physical Education Association*—1938, '39, '40, '41, '48, '49, '51, '52, each $1.75; 1953, $2.00

4. *American Academy of Physical Education—Professional Contributions.* Papers and reports presented at the annual meetings— *No. 1*—1950—51. 94 pp. $1.50; *No. 2*—1952. 88 pp. $1.50

5. *Physical Education—An Interpretation.* Third version of the Platform for Physical Education. 2-9 copies, 35c each; 10-99 copies, 25c each; 100 or more, 10c each. Single copy, 50c

6. *Desirable Athletic Competition for Children.* Joint Committee Report: AAHPER, Society of State Directors of Health, Physical Education, and Recreation, and Elementary School Principals (NEA). A guide for those concerned with athletics for children. 2-9 copies, 35c each; 10-99 copies, 25c each; 100 or more, 20c each. Single copy, 50c

7. *Recreation Bibliography.* An up-to-date list of books, with authors, publishers, dates of publication, pages, and prices. 1952. 71 pp. $1.00

8. *Annotated Recreation Bibliographies,* 1939-51, prepared by Eleanor L. Wright

Canoeing	25c	*Sailing*	35c
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9. *Evaluation Schedules for Major Programs in Health Education, Physical Education, and Recreation,* prepared as part of the American Association of Colleges for Teachers Education accreditation plan. 1952. A set of schedules (all 3 areas) $1.00; Separate schedule (one area) 50c

10. ***Putting PR into HPER.* Public Relations Handbook designed especially for health educators, physical educators, and recreation personnel. Published jointly by AAHPER and the National School Public Relations Association. 1953. 68 pp. $1.00

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